Eng'g NASA 914
2/05

Scientific and Technical Aerospace Reports

A SEMI-MONTHLY ABSTRACT JOURNAL WITH INDEXES

APR 28 1964

MARCH 8, 1964

VOLUME 2 • NUMBER 5

N64-13410– N64-14170

DOCUMENTS
APR 13 1964
Duke University Library

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Purchase of *STAR*

The semimonthly issues and the cumulative index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., 20402, United States of America.

Semimonthly issues. Annual subscription rate: $25.00, domestic; $31.00, foreign. Price per single copy: $1.50, domestic; 25¢ extra for foreign mailing.

Cumulative index issues. Annual subscription rate: $30.00, domestic; $34.00, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Payment should be by check, money order, or document coupons, and must accompany order. Remittances from foreign countries should be made by international money order, or draft on an American bank, payable to the Superintendent of Documents, or by UNESCO book coupons.

Published by:
United States Government
National Aeronautics and Space Administration
Scientific and Technical Information Division

Scientific and Technical Aerospace Reports, Volume 2, is prepared by the Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Documentation Incorporated.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget December 20, 1962

Introduction

Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published twice each month.

Three major areas are covered in *STAR*:

1. Scientific and technical reports of the National Aeronautics and Space Administration and its contractors.
2. Scientific and technical reports of government agencies, universities, and research organizations throughout the world.
3. Scientific and technical articles prepared by employees of NASA and its contractors that appear in the learned and technical journals.

What STAR Is

The first section of *STAR*, arranged by subject categories, contains informative abstracts and complete bibliographic citations. A second section consists of five indexes: subject, corporate source, author, report number, and accession number. Separate cumulative indexes are published quarterly, semiannually, and annually.

How STAR Is Organized

Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may wish instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

How to Use STAR

NASA documents (identified with an asterisk), as well as *STAR* itself, are available without charge to:

1. NASA Offices, Centers, contractors, subcontractors, grantees, and consultants.
2. Other U.S. Government agencies and their contractors.
3. Libraries that maintain depositories of NASA documents for public reference.
4. Other organizations having a need for NASA documents in work related to the aerospace program.
5. Foreign organizations that exchange publications with NASA, or that maintain depositories of NASA documents for public use.

AGARD reports that are not commercially available will also be provided by NASA to the organizations listed above.

Other non-NASA documents are provided without charge only to NASA Offices, Centers, contractors, subcontractors, grantees, and consultants.

Availability of STAR and Documents

How to Request Listed Documents

If you are registered with NASA, send a completed *Document Request* (Facility Form 492) to:

Scientific and Technical Information Facility
P. O. Box 5700
Bethesda, Maryland 20014

If you are eligible to receive documents without charge but are not registered with NASA, request *Registration Form—Technical Publications* (NASA Form 439) from:

Scientific and Technical Information Division
National Aeronautics and Space Administration
Code ATSS-AD
Washington, D.C., 20546

How the Public May Obtain Listed Documents

For reference purposes, NASA documents listed in *STAR* may be consulted at one of the organizations listed on the inside back cover. Commercial publications listed in *STAR* may usually be consulted in libraries or purchased from publishers or booksellers.

The public may purchase NASA documents listed in STAR from either of two sales agencies, as specifically identified in the abstract section:

Office of Technical Services (OTS)	Superintendent of Documents (GPO)
U.S. Department of Commerce	U.S. Government Printing Office
Washington, D.C. 20230	Washington, D.C. 20402

The public may purchase non-NASA documents by writing to the source, or to other information systems.

Abstracts of Journal Articles

By special arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts* is issued in coordination with *STAR*. Each journal appears on alternate weeks. *IAA* uses identical subject categories with those in *STAR*, and publishes identical indexes. *IAA's* worldwide coverage of books and scientific and trade journals complements *STAR's* worldwide report coverage. The two publications thus provide comprehensive access to current literature on aerospace science and technology.

Organizations having contractual relations with NASA may obtain *IAA* by writing NASA, Code ATSS-A, Washington, D.C. 20546. Others should direct inquiries to the American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, N.Y., 10017

Scientific and Technical Information Division
National Aeronautics and Space Administration

Table of Contents

Volume 2 Number 5 March 8, 1964

Abstracts in the journal are grouped under the following categories: PAGE

01 GENERAL
Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or a general nature 527

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW
Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics. 532

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES
Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics. 533

04 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles. 535

05 ASTRONOMY AND ASTROPHYSICS
Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics; and 29 Space Sciences. 537

06 AUXILIARY SYSTEMS
Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance. 538

07 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion. 541

08 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance. 546

09 ELECTRONICS
Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State. 549

10 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see*: 06 Auxiliary Systems. 553

11 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma. 555

12 GEOPHYSICS
Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences. 558

13 HEAT TRANSFER AND THERMODYNAMICS
Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics. . . 560

14 HUMAN BEHAVIOR
Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences. 562

15 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance. 564

16 LIFE SCIENCES
Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation. 566

17 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems. 578

18 MATERIALS, METALLIC
Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design. 582

19 MATERIALS, NONMETALLIC
Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design. 588

20 MATHEMATICS
Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance. 591

21 METEOROLOGY
Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences. 597

22 NAVIGATION AND GUIDANCE
Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences. 599

23 PHYSICS, GENERAL
Includes acoustics; cryogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related informations see*: 12 Geophysics; 24 Physic, Plasma; 25 Physics, Solid-State; and 29 Space Sciences. 599

24 PHYSICS, PLASMA
Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State. 615

25 PHYSICS, SOLID-STATE
Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma. 621

26 PROPELLANTS AND COMBUSTION
Includes fuels; igniters; and oxidizers. *For related information see*: 07 Chemistry; and 27 Propulsion. 629

27 PROPULSION
Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles. 632

28 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences. 633

29 SPACE SCIENCES
Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance. 634

30 SPACE VEHICLES
Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance. 638

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance. 639

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance. 639

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design. 639

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads. 642

SUBJECT INDEX I-1

CORPORATE SOURCE INDEX I-59

PERSONAL AUTHOR INDEX I-79

REPORT/ACCESSION NUMBER INDEX I-113

ACCESSION/REPORT NUMBER INDEX I-121

VOLUME 2 NUMBER 5

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

March 8, 1964

01 GENERAL

Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

N64-13417 Joint Publications Research Service, Washington, D.C.
SELECTIONS ON TITANIUM AND ITS ALLOYS FROM AVTOMATICHESKAYA SVARKA [KIEV, NO. 10, OCT. 1963]
30 Dec. 1963 29 p refs Transl. into ENGLISH of 4 articles p 33–42, 82–86, and 90
(JPRS-22492; OTS-64-21147) OTS: $0.75

CONTENTS:

1. SUBMERGED-ARC WELDING OF OT4 TITANIUM-ALLOY PARTS V. B. Volkov and O. A. Maslyukov p 1–7 refs (See N64-13418 05-17)
2. ELECTROSLAG MELTING OF TITANIUM-ALLOY INGOTS S. M. Gurevich, V. P. Didkovskiy, and Yu. K. Novikov p 8–16 refs (See N64-13419 05-17)
3. JOINING TITANIUM BY VACUUM-DIFFUSION WELDING N. F. Kazakov, A. P. Shishkova, and K. Ye. Charukhina p 17–24 refs (See N64-13420 05-17)
4. CORROSION STABILITY OF TITANIUM ALLOYS JOINED BY DIFFUSION WELDING G. K. Kharchenko and L. N. Yagupol'skaya p 25–28 refs (See N64-13421 05-07)

N64-13426 Technical Operations, Inc., Burlington, Mass.
INVESTIGATION OF COHERENT OPTICAL PROPAGATION Technical Documentary Report
Thomas J. Skinner Griffiss AFB, N.Y., Advanced Develop. Lab., Nov. 1963 107 p refs
(Contract AF 30(602)-2619)
(RADC-TDR-63-217; AD-424928)

CONTENTS:

1. INVESTIGATION OF COHERENT OPTICAL PROPAGATION T. J. Skinner p 1–70 refs (See N64-13427 05-25)
2. DIFFRACTION OF PARTIALLY COHERENT LIGHT BY A PLANE APERTURE G. B. Parrent, Jr. and T. J. Skinner (AF Cambridge Res. Lab.) 10 p refs (See N64-13428 05-25)
3. QUANTUM-MECHANICAL CORRELATION THEORY OF ELECTROMAGNETIC FIELDS J. Sarfatt 11 p refs (See N64-13429 05-23)
4. ON THE MUTUAL COHERENCE FUNCTION IN AN INHOMOGENEOUS MEDIUM G. B. Parrent, Jr., R. A. Shore (AF Cambridge Res. Labs.), and T. J. Skinner 7 p refs (See N64-13430 05-23)

N64-13431 Aeronautical Systems Div., Wright-Patterson AFB, Ohio Flight Dynamics Lab.
PROCEEDINGS OF SYMPOSIUM ON STRUCTURAL DYNAMICS UNDER HIGH IMPULSE LOADING
L. R. Standifer et al May 1963 429 p refs Symp. held in Dayton, Ohio, 17–18 Sep. 1962
(ASD-TDR-63-140; AD-408777)

CONTENTS:

1. INTRODUCTORY REMARKS L. R. Standifer p 1–3
2. WELCOMING ADDRESS R. C. Ruegg p 5–8
3. KEYNOTE ADDRESS F. J. Ascani p 9–12
4. TECHNICAL SESSION 1: MECHANICAL PROPERTIES OF SOLIDS D. C. Drucker (Brown U.) p 13–16
5. DYNAMIC PROPERTIES OF MATTER UNDER HIGH STRESS. THERMODYNAMIC DESCRIPTIONS H. L. Brode and A. C. Smith (RAND Corp.) p 17–36 refs (See N64-13432 05-23)
6. ORIENTED SOLIDS J. L. Ericksen (Johns Hopkins U.) p 37–57 refs (See N64-13433 05-25)
7. DEFECTS IN SOLIDS AT HIGH VELOCITY DEFORMATION A. N. Stroh (Mass. Inst. of Tech.) p 59–78 refs (See N64-13434 05-25)
8. DYNAMIC ANALYSIS IN VISCOELASTIC MEDIA M. L. Williams and R. J. Arenz (Calif. Inst. of Tech.) p 79–116 refs (See N64-13435 05-23)
9. TECHNICAL SESSION 2: WAVE PROPAGATION PHENOMENA AND STRUCTURAL RESPONSE W. Goldsmith (Calif. U.) p 117–121 (See N64-13436 05-23)
10. WAVE PROPAGATION IN UNIAXIAL STRAIN J. H. Percy (Mass. Inst. of Tech.) p 123–146 refs (See N64-13437 05-25)
11. UNIAXIAL STRESS CONDITIONS G. L. Filbey, Jr. (Pa. U.) p 147–172 refs (See N64-13438 05-25)
12. DISLOCATION CONCEPTS OF STRAIN RATE EFFECTS J. E. Dorn and F. E. Hauser (Calif. U.) p 173–205 refs (See N64-13439 05-25)
13. SOME PROBLEMS IN DYNAMIC RESPONSE OF TWO-DIMENSIONAL STRUCTURES W. H. Hoppmann II (Rensselaer Polytech. Inst.) p 207–223 refs (See N64-13440 05-23)
14. TECHNICAL SESSION 3: HYPERVELOCITY IMPACT R. Bisplinghoff (NASA, Wash.) p 225–228
15. STATUS OF THEORY R. L. Bjork (RAND Corp.) p 229–234

16. HYPERVELOCITY IMPACT STATUS OF EXPERIMENTS W. Herrmann and A. H. Jones (Mass. Inst. of Tech.) p 235–255 refs (See N64-13441 05-23)

17. PROJECTION TECHNIQUES J. S. Curtis and J. W. Gehring (Gen. Motors Corp.) p 257–288 refs (See N64-13442 05-23)

18. TECHNICAL SESSION 4: FRACTURE PHENOMENA H. J. Plass (Texas U.) p 289–292 (See N64-13443 05-25)

19. FRACTURE BY PROGRESSIVE CRACK EXTENSION G. R. Irwin (Naval Res. Lab.) p 293–323 refs (See N64-13444 05-25)

20. TIME DEPENDENT FRACTURE C. C. Hsiao (Minn. U.) p 325–355 refs (See N64-13445 05-25)

21. SPALL FRACTURE C. D. Lundergan (Sandia Corp.) p 357–382 refs (See N64-13446 05-25)

22. SESSION 5: PANEL FOR FUTURE RESEARCH OBJECTIVES L. R. Standifer p 383–418

N64-13450 Centre National D'Etudes Spatiales, Paris (France)

ANNUAL PROGRESS REPORT, 1 SEPTEMBER 1962-1 SEPTEMBER 1963 [RAPPORT D'ACTIVITE]

[21 Oct. 1963] 127 p In FRENCH

French progress is reported in developing a space policy to: (1) realize a French satellite placed in orbit by a French launcher, and (2) actively participate in European space organizations. Scientific and technical activities in the fields of balloons, sounding rockets, satellites, tracking and telemetry stations, and advanced programs, as well as supporting documentation, funding, and administration activities are discussed. M.P.G.

N64-13451 Advisory Group for Aeronautical Research and Development, Paris (France)

BIO-ASSAY TECHNIQUES FOR HUMAN CENTRIFUGES AND PHYSIOLOGICAL EFFECTS OF ACCELERATION

P. Bergeret, ed. Wash., D.C., Pergamon, 1961

(AGARDograph-48) · Available from Pergamon Press:$10.00

CONTENTS:

1. THE HUMAN CENTRIFUGE AND ITS APPLICATION TO PILOT SELECTION S. Ruff (DVL, Bad Godesberg) p 1–13 refs (See N64-13452 05-16)

2. SOME RECENT DEFINITIONS OF THE ACCELERATION PROBLEM W. R. Franks (RCAF, Toronto) p 14–22 refs (See N64-13453 05-16)

3. A REVIEW OF THE PHYSIOLOGICAL EFFECTS OF ANGULAR ACCELERATIONS W. H. Johnson and N. B. G. Taylor (Def. Res. Med. Labs., Toronto) p 23–34 refs (See N64-13454 05-16)

4. HUMAN TOLERANCE AND LIMITATIONS TO ACCELERATION R. N. Headley (Aerospace Med. Div., Wright-Patterson AFB) p 35–41 refs (See N64-13455 05-16)

5. INSTRUMENTATION AND THE HUMAN CENTRIFUGE G. H. Byford (RAF, Farnborough) p 42–51 refs (See N64-13456 05-15)

6. CENTRIFUGE METHODS AND TECHNIQUES IN THE U.S. NAVY F. K. Smith (Nav. Air Develop. Center, Johnsville) p 52–58 refs (See N64-13457 05-16)

7. END POINTS FOR ACCELERATION TOLERANCES ON THE CENTRIFUGE M. G. Webb (Nav. Air Develop. Center, Johnsville) p 59–64 refs (See N64-13458 05-16)

8. A DISCUSSION ON RESTRAINT AND PROTECTION OF THE HUMAN EXPERIENCING THE SMOOTH AND OSCILLATING ACCELERATIONS OF PROPOSED SPACE VEHICLES C. C. Clark and R. F. Gray (Nav. Air Develop. Center, Johnsville) p 65–95 refs (See N64-13459 05-16)

9. THE EFFECTS OF FORWARD ACCELERATION ON RESPIRATION W. G. Blanchard (Aerospace Med. Div., Wright-Patterson AFB) p 96–100 refs (See N64-13460 05-16)

10. THE PHYSIOLOGICAL EFFECTS OF ACCELERATION ON RESPIRATION AND PROTECTIVE MEASURES A. S. Hyde (Aerospace Med. Div., Wright-Patterson AFB) p 101–106 refs (See N64-13461 05-16)

11. EFFECTS OF REPEATED POSITIVE ACCELERATIONS OF LOW INTENSITY AND LONG DURATION. ANATOMICAL STUDY ON THE DOG KIDNEY R. Senelar, R. Loubiere, and F. Violette p 107–118 refs (See N64-13462 05-16)

12. CARDIOVASCULAR EFFECTS OF FORWARD ACCELERATION G. C. E. Mueller (Aerospace Med. Div., Wright-Patterson AFB) p 119–129 refs (See N64-13463 05-16)

13. HOST FACTORS IN RESISTANCE TO ACCELERATION STRESS E. R. Stiehm (Nav. Air Develop. Center, Johnsville) p 130–139 refs (See N64-13464 05-16)

14. ADVANTAGE AND LIMITS OF RESEARCHES CARRIED OUT ON ANIMALS AND ON MAN BY MEANS OF CENTRIFUGES R. Grandpierre, E. Violette, R. Flandrois, and J. B. Tosan p 140–146 (See N64-13465 05-16)

15. MEDICAL MACHINE RECORD CARDS—THEIR DEVELOPMENT AND USE IN THE ASTRONAUT SELECTION PROGRAM A. H. Schwichtenberg (Lovelace Found. for Med. Educ. and Res.), D. D. Flickinger (AFSC, Andrews AFB), and W. R. Lovelace II p 147–173 refs (See N64-13466 05-16)

N64-13475 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (W. Germany) Wissenschaftliches Sekretariat

ACTIVITIES REPORTS-1962 [TATIGKEITSBERICHTE-1962]

Peter Bruders, ed. Sep. 1963 132 p refs In GERMAN (DVL Ann. 6)

Activity reports from the following institutes are presented: (1) applied gas dynamics; (2) theoretical gas dynamics; (3) turbulence research; (4) applied mathematics and mechanics; (5) jet engines; (6) propulsion mechanics; (7) aircraft and spacecraft stability (static, dynamic, and aerothermodynamic); (8) materials research; (9) chemical rocket propulsion; (10) rocket propellants; (11) propellants and lubricants; (12) spectroscopy and molecular beam technique; (13) space travel research; (14) plasma dynamics; (15) flight mechanics; (16) free-flight research; (17) navigation and guidance; (18) aircraft radio and microwaves; (19) atmospheric physics; (20) carriers for meteorological and aerophysical measuring devices; and (21) flight medicine. I.v.L.

N64-13476 Virginia U., Charlottesville

PROJECT SQUID Semi-Annual Progress Report, 1 Apr.-30 Sep. 1963

1 Oct. 1963 86 p refs

(Contract Nonr-3623(00))

(AD-420576)

CONTENTS:

1. FUNDAMENTAL INVESTIGATION OF NONSTEADY AND NONEQUILIBRIUM FLOW G. Rudinger (Cornell Aeron. Lab.) p 1–4 refs (See N64-13477 05-24)

2. INVESTIGATION OF TURBULENCE L. S. G. Kovasznay (Johns Hopkins U.) p 5–8 refs (See N64-13478 05-24

3. FUNDAMENTAL STUDY OF DYNAMICS OF GASES AND PLASMAS G. Sandri, R. D. Sullivan, T. F. Morse and E. A. Frieman (Aeron. Res. Assoc. of Princeton) p 9–12 refs (See N64-13479 05-24)

4. RESEARCH ON THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASES AT HIGH TEMPERATURES AND PRESSURES J. Kestin, J. Ross, J. H. Whitelaw, A. Nagashima, R. DiPippo et al (Brown U.) p 13–18 (See N64-13480 05-24)

5. PROPERTIES OF TWO-PHASE FLOW—ELECTRIC PHENOMENA S. L. Soo, J. A. Hultberg, G. J. Trezek, and R. C. Dimick (Illinois U.) p 19–21 refs (See N64-13481 05-24)

6. THERMAL CONDUCTIVITY OF GASES AND LIQUIDS OVER A RANGE OF TEMPERATURES AND PRESSURES F. G. Keyes (Mass. Inst. of Tech.) p 23–25 refs (See N64-13482 05-24)

7. A STUDY OF FLUID FLOW WITH SUSPENDED PARTICLES R. Eichborn, J. Muir, U. Navon, and R. Shanny (Princeton U.) p 27–29 refs (See N64-13483 05-24)

8. THEORY OF FAST REACTIONS A. K. Oppenheim, R. W. Getzinger, and R. De Vogelaere (Calif. U.) p 31–34 refs (See N64-13484 05-24)

9. KINETICS OF ELEMENTARY REACTIONS B. deB. Darwent and A. L. Flores (Catholic U.) p 35–36 (See N64-13485 05-24)

10. INVESTIGATION OF REACTION KINETICS IN HIGH-TEMPERATURE GASES G. M. Markstein (Cornell Aeron. Lab.) p 37–43 refs (See N64-13486 05-24)

11. REACTIONS OF IONS AND ELECTRONICALLY EXCITED SPECIES WITH ATOMS AND MOLECULES IN THE GAS PHASE J. L. Franklin, F. H. Field, and M. S. B. Munson (Humble Oil and Refining Co.) p 45–49 (See N64-13487 05-24)

12. CHEMICAL KINETICS AND GAS DYNAMICS OF ATOM AND FREE-RADICAL REACTIONS H. Wise, C. M. Ablow, Y. Rajapakse, D. Schott, and B. J. Wood (Stanford Res. Inst.) p 51–57 refs (See N64-13488 05-24)

13. INELASTIC MOLECULAR COLLISIONS J. E. Scott, Jr., D. G. Griffith, J. H. Heald, and J. A. Phipps (Va. U.) p 59–62 refs (See N64-13489 05-24)

14. SOLID-PROPELLANT FLAME MECHANISMS R. Friedman, A. Macek, and J. M. Semple (Atlantic Res. Corp.) p 63–65 refs (See N64-13490 05-24)

15. MAGNETOHYDRODYNAMICS OF PARTIALLY IONIZED GASES J. A. Fay, W. C. Moffatt, R. L. Leonard, M. Sajben, and J. B. Workman (MIT) p 67–70 refs (See N64-13491 05-04)

16. ENTHALPY FLUCTUATIONS IN PLASMA JETS P. L. Blackshear, Jr., D. Y. Cheng, G. O. Voss, H. Wu, W. H. Kuretsky et al (Minn. U.) p 71–82 refs (See N64-13492 05-24)

N64-13543 Firestone Tire and Rubber Co., Akron, Ohio
PROCEEDINGS OF THE SIXTH SYMPOSIUM ON HYPERVELOCITY IMPACT, CLEVELAND, OHIO, APRIL 30-MAY 2, 1963, VOLUME 3
L. Zernow et al Aug. 1963 407 p refs
(Contract DA-31-124-ARO(D)-16)
(AD-423802)

CONTENTS:

1. EXPERIMENTATION—INTRODUCTORY PAPER L. Zernow (Aerojet-Gen. Corp.) p 1–11 refs (See N64-13544 05-01)

2. TWO DIMENSIONAL ANALYSIS OF A HYPERVELOCITY IMPACT UPON A VISCO-PLASTIC PLATE H. Kraus (Pratt and Whitney Aircraft) p 13–40 refs (See N64-13545 05-23)

3. A METEOROID BUMPER DESIGN CRITERION P. E. Sandorff (Lockheed Missiles and Space Co.) p 41–67 refs (See N64-13546 05-34)

4. EXPERIMENTAL AND THEORETICAL RESULTS CONCERNING THE PROTECTIVE ABILITY OF A THIN SHIELD AGAINST HYPERVELOCITY PROJECTILES C. J. Maiden (Gen. Motors Corp.) p 69–156 refs (See N64-13547 05-33)

5. EFFECTS OF 3 TO 12 KM/SEC IMPACTS ON FINITE TARGETS R. B. Mortensen, J. E. Ferguson, J. P. Joyce, and K. N. Kreyenhagen (Aerojet-Gen. Corp.) p 157–205 refs (See N64-13548 05-23)

6. THIN PLATE PERFORATION STUDIES WITH PROJECTILES IN THE VELOCITY RANGE FROM 2 TO 5 KM/SEC R. W. Watson, K. R. Becker and F. C. Gibson (Bur. of Mines) p 207–248 refs (See N64-13549 05-23)

7. A NEW SYSTEM OF PROTECTION FROM HYPERVELOCITY PARTICLES B. W. Reynolds and R. H. Emmons (Goodyear Aircraft Corp.) p 249–279 refs

8. HYPERVELOCITY PUNCTURING OF SELF-SEALING STRUCTURES Philip J. D'Anna (Northrop Corp.) p 281–308 refs (See N63-15390 12-34)

9. AN INVESTIGATION OF THE PENETRATION OF HYPERVELOCITY PROJECTILES INTO COMPOSITE LAMINATES A. R. Mc Millan (Gen. Motors Corp.) p 309–356 refs (See N64-13550 05-33)

10. METEOROID EFFECTS ON NUCLEAR ROCKET SPACE VEHICLE MISSION SUCCESS W. H. Sterbentz and L. L. Long (Lockheed Missiles and Space Co.) p 357–385 refs (See N63-23694 24-29)

11. THIN PLATE PERFORATION AND PROTECTION D. M. Davis (AFSC, Eglin AFB) p 387–391 (See N64-13551 05-23)

N64-13544 Aerojet-General Corp., Downey, Calif. Ordnance Div.
EXPERIMENTATION Introductory Paper
L. Zernow *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 1–11 refs (See N64-13543 05-01)

Historical aspects of experimental work are discussed, and critical remarks are made concerning experimenters and their claims for experimental techniques. Comments are also made on the relationship of the experimenters with the theoreticians. C.L.W.

N64-13552 Advisory Group For Aeronautical Research and Development, Paris (France)
MANUAL ON AEROELASTICITY. VOLUME 1, PART 1: STRUCTURAL ASPECTS
W. P. Jones, ed. (Natl. Phys. Lab.) Jan. 1961 410 p refs

CONTENTS:

1. INTRODUCTORY SURVEY W. J. Duncan (Glasgow U.) 53 p refs (See N64-13553 05-33)

2. ANALYTICAL REPRESENTATION OF THE DEFORMATION OF STRUCTURES W. S. Hemp (Coll. of Aeron. Gt. Brit.) 22 p refs (See N64-13554 05-33)

3. VIBRATION ANALYSIS OF AIRCRAFT STRUCTURES J. M. Hedgepeth (NASA, Langley Res. Center) 20 p refs (See N64-13555 05-33)

4. INFLUENCE OF INTERNAL DAMPING ON AIRCRAFT RESONANCE B. M. F. de Veubeke (Liège U.) 40 p refs (See N64-13556 05-33)

5. VIBRATION TESTING BY HARMONIC EXCITATION H. Gauzy (France, ONERA) 23 p refs (See N64-13557 05-33)

6. VIBRATION TESTING BY TRANSIENT EXCITATION G. Coupry (France, ONERA) 19 p refs (See N64-13558 05-33)

7. PROBLEMS PECULIAR TO CONTROL SURFACES C. Beatrix (France, ONERA) 7 p refs (See N64-13559 05-03)

8. GENERAL REMARKS ON THE PROBLEM OF SUSPENSION J. Leclerc (France. ONERA) 22 p refs (See N64-13560 05-23)

9. PROBLEMS PECULIAR TO SMALL MODELS AND TO COMPRESSOR BLADES R. Dat (France. ONERA) 14 p refs (See N64-13561 05-03)

10. THE INFLUENCE OF POWERED CONTROLS D. Benun (Aerolab Develop. Co.) 48 p refs (See N64-13562 05-03)

11. STRUCTURAL NON-LINEARITIES D. L. Woodcock (RAE) 52 p refs (See N64-13563 05-33)

12. THERMOELASTICITY R. L. Bisplinghoff (MIT) 52 p refs (See N64-13564 05-23)

N64-13565 Joint Publications Research Service, Washington, D.C.

NEWS OF HIGHER EDUCATIONAL INSTITUTIONS. MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION, USSR. INSTRUMENT BUILDING SERIES, VOLUME 6, NO. 2, 1963

30 Dec. 1963 195 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenil. Priborostr. (Leningrad) p 3–158 refs (JPRS-22479; OTS-64-21137) CFSTI: $3.00

CONTENTS:

1. DEVICE FOR MEASURING THE PHASE VELOCITY OF SURFACE WAVES Y. V. Kuznetsov p 1–7 refs (See N64-13566 05-23)

2. CONCERNING THE PERFORMANCE OF PHOTOTUBES AT REDUCED VOLTAGE V. M. Zhestyanikov and L. S. Grinberg p 8–13 refs (See N64-13567 04-09)

3. CONCERNING THE EFFECT OF MINOR PARAMETERS ON THE STABILITY OF TYPICAL AUTOMATIC CONTROL SYSTEMS 1 (INSIDE CIRCUIT) B. G. Sirazitdinov p 14–31 refs (See N64-13568 05-06)

4. APPROXIMATE DIFFERENTIATION OF FREQUENCY-PULSE INFORMATION R. G. Karpov p 32–39 refs (See N64-13569 05-08)

5. SYNTHESIS OF AN AUTOMATIC SYSTEM WITH A DIGITAL CONTROLLING MACHINE A. P. Litvinov p 40–51 refs (See N64-13570 05-06)

6. APPROXIMATE DETERMINATION OF NUMBER OF SECTIONS IN PIECEWISE-LINEAR APPROXIMATION L. P. Afinogenov p 52–61 refs (See N64-13571 05-20)

7. GYROSCOPIC TACHOMETERS AND TACHOACCELEROMETERS WITH PRESSURE PICKUPS A. A. Odintsov p 62–71 (See N64-13572 05-15)

8. DETERMINATION OF FORCED OSCILLATIONS IN NONLINEAR STABILIZING SYSTEMS Yu. M. Khovanskiy, P. A. Severov, and V. S. Slepkov p 72–84 refs (See N64-13573 05-23)

9. CONCERNING THE CREATION OF A GYROSCOPIC LATITUDE COMPASS M. M. Bogdanovich and P. A. Il'in p 85–114 refs (See N64-13574 05-22)

10. DESIGN OF ISOPLANETIC SYSTEMS A. P. Dmitriyev p 115–124 refs (See N64-13575 05-16)

11. MOTION OF RUBBER-CUSHIONED INSTRUMENT MECHANISM DURING IMPACT TESTS V. S. Novoselov p 125–134 refs (See N64-13576 05-15)

12. RESILIENT GUIDES IN DEVICES. (A REVIEW) V. N. Zheludkov p 135–153 refs (See N64-13577 05-17)

13. HEAT CONDITIONS IN RADIO AND ELECTRONIC PERFORATED APPARATUS G. N. Dul'nev and E. M. Semyashkin p 154–163 refs (See N64-13578 05-13)

14. ACALORIMETERS WITH OPEN SURFACES A. F. Begunkova p 164–175 refs (See N64-13579 05-13)

15. CALCULATION OF ERRORS IN MACHINING PARTS BY THE METHOD OF LATERAL TURNING AND RADIAL FEED M. A. Luzhnikovskaya p 176–183 refs (See N64-13580 05-17)

16. MULTI-RANGE POTENTIOMETER BRIDGE G. P. Buynyachenko p 184–186 (See N64-13581 05-15)

N64-13585 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 67

16 Jan. 1964 59 p refs Transl. into ENGLISH from K'o-hsueh T'ung'Pao (Peking), no. 9, Sep. 1963 p 27–42 and 50–52 (JPRS-22766; OTS-64-21308) OTS: $1.50

CONTENTS:

1. NEW PROGRESS IN TETRACYCLINE CHEMISTRY T. Li-hsin p 1–46 refs

2. OPTICAL PROPERTIES OF OXIDIZED COMPOUNDS OF THE RARE EARTH METALS IN INORGANIC GLASS K. Fu-hsi, C. Chung-hung, and T. Ying-shih p 47–56 refs (See N64-13586 05-23)

N64-13676 Joint Publications Research Service, Washington, D.C.

NEW METHODS IN ASTRONOMY

B. K. Ioannisiani et al 10 Jan. 1964 158 p refs Transl. into ENGLISH of portions of the publ. "Novaya tekhnika v astronomii", Moscow, Acad. of Sci. USSR Publ. House, 1963 p 3–36, 80–104, 108–117, 142–158, and 169–175 (JPRS-22696; OTS-64-21262) OTS: $3.00

CONTENTS:

1. NEW SOVIET TELESCOPE—THE LARGEST IN EUROPE B. K. Ioannisiani, A. B. Severnyy, and P. I. Shelovitelev p 5–10 (See N64-13677 05-10)

2. THE 2.6-m MIRROR REFLECTOR IMENI AKADEMIK G. A. SHAYN B. K. Ioannisiani p 11–18 (See N64-13678 05-23)

3. THE CONTROL SYSTEM FOR THE 2.6-m TELESCOPE N. S. Zhurkin, V. M. Konshin, and G. L. Bruk p 19–23 (See N64-13679 05-06)

4. PROCESSING AND PRELIMINARY INVESTIGATIONS OF THE MAIN MIRROR (2.6-m) FOR THE TELESCOPE OF THE CRIMEAN ASTROPHYSICAL OBSERVATORY V. V. Oshurko p 24–33 (See N64-13680 05-17)

5. THE CONTROL SYSTEM OF THE RM-700 TELESCOPE Yu. A. Belyayev, T. S. Gerasimova, Z. V. Dravskikh, N. N. Mikhel'son, V. S. Sumin et al p 34–42 refs (See N64-13681 05-06)

6. THE SYSTEM OF AUTOMATIC CONTROL AND POINTING OF AN AZIMUTHAL TELESCOPE Yu. A. Sabinin and P. V. Nikolayev p 43–55 refs (See N64-13682 05-06)

7. AUTOMATIC COMPENSATION FOR THE SAGGING OF STELLAR TELESCOPES G. I. Goreva, Yu. A. Sabinin, P. V. Nikolayev, and A. V. Shumakher p 56–75 refs (See N64-13683 05-06)

8. PHOTOELECTRIC METHOD OF STUDYING THE INSTABILITY OF STELLAR IMAGES I. P. Rozhnova and Yu. A. Sabinin p 76–85 refs (See N64-13684 05-23)

9. SYSTEM OF PROGRAMMED CONTROL OF A TELESCOPE INTENDED FOR OBSERVATIONS UNDER LIMITED PROGRAMS Z. N. Kuteva and Yu. A. Sabinin p 86–101 refs (See N64-13685 05-20)

10. CAMERA WITH AN OPTICAL COMPENSATOR FOR OBSERVING ARTIFICIAL EARTH SATELLITES Kh. I. Potter and Yu. S. Streletskiy p 102–115 refs (See N64-13686 05-23)

11. AUTOMATIC ELECTRON POLARIMETER AND OTHER DEVICES L. V. Ksanfomaliti p 116–129 refs (See N64-13687 05-15)

12. STELLAR PHOTOMETER AND SPECTROMETER FOR THE 1-2.5 MU REGION V. I. Moroz p 130–141 refs (See N64-13688 05-15)

13. FABRY-PEROT STANDARD WITH AN IMAGE AMPLIFIER FOR OBSERVATION OF LOW-EMISSION OBJECTS P. V. Shcheglov p 142–147 (See N64-13689 05-15)

14. EXPERIENCE GAINED IN USING A VACUUM CHAMBER FOR TESTING THE PRECISE MIRRORS OF ASTRONOMICAL INSTRUMENTS V. A. Savin p 148–152 (See N64-13690 05-10)

15. INTERFERENCE POLARIZATION FILTER FOR ASTROPHYSICAL INVESTIGATIONS OF THE SUN IN THE K LINE OF IONIZED CALCIUM S. B. Ioffe and N. M. Drichko p 153–154 (See N64-13691 05-23)

N64-13697 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM POROSHKOVAYA METALLURGIYA (POWDER METALLURGY) [KIEV, V. 3] NO. 5, 1963

V. N. Yeremenko et al 8 Jan. 1964 29 p refs Transl. into ENGLISH of 3 articles p 3–9, 43–46, and 68–76 (JPRS-22655; OTS-64-21237) OTS: $0.75

CONTENTS:

1. REACTION OF MOLYBDENUM WITH TITANIUM CARBIDE V. N. Yeremenko and T. Ya. Velikanova p 1–9 refs (See N64-13698 05-07)

2. WETTABILITY OF NbC-VC and NbC-TiC ALLOYS WITH NICKEL V. I. Tumanov, V. F. Funke, and L. I. Belen'kaya p 10–14 refs (See N64-13699 05-19)

3. NITRIDING ALUMINUM POWDER AND DUST TO PRODUCE ALUMINUM NITRIDE Yu. D. Repkin and G. V Samsonov p 15–26 refs (See N64-13700 05-07)

N64-13701 North American Aviation, Inc., Downey, Calif. Space and Information System Div.

PROCEEDINGS OF THE [13th] LUNAR AND PLANETARY EXPLORATION COLLOQUIUM, VOLUME 3, NUMBER 3

G. A. Smith et al Nov. 1963 143 p refs Meeting held in Downey, Calif., May 6–7, 1963

CONTENTS:

1. THE MANNED LUNAR BASE G. A. Smith (NASA) p 3–9 (See N64-13702 05-29)

2. IMPORTANT EXPERIMENTS IN ASTRONOMY TO BE CONDUCTED ON THE MOON D. Alter (Griffith Obs.) p 11–14 ref (See N64-13703 05-29)

3. THE LUNAR ATMOSPHERE AND ITS RELATIONSHIP TO THE SOLAR WIND W. Bernstein, R. W. Fredricks, and J. L. Vogl (Space Technol. Labs.) p 15–21 refs (See N64-13704 05-29)

4. THE PHYSICAL NATURE OF LUNAR SURFACE MATERIAL A. R. Hibbs (JPL) p 23–28 refs (See N64-13705 05-29)

5. THE SHAPE OF THE MOON: A SPECIAL REPORT L. Larmore (Lockheed-Calif. Co.) p 29–30 (See N64-13706 05-05)

6. CONCEPTS OF BASE CONSTRUCTION ON THE MOON G. W. S. Johnson (North Am. Aviation) p 31–37 refs (See N64-13707 05-29)

7. THE IMPLICATIONS OF WATER AS A LUNAR RESOURCE P. E. Glaser, A. E. Wechsler, and J. W. Salisbury (Little (Arthur D.) Inc.) p 39–53 refs (See N64-13708 05-29)

8. EXPLORATION FOR LUNAR WATER DEPOSITS J. R. Van Lopik and K. Westhusing (Tex. Instr.) p 55–63 refs (See N64-13709 05-29)

9. SOME ASPECTS OF LUNAR SOIL BEHAVIOR J. A. Ryan (North Am. Aviation) p 65–71 refs (See N64-13710 05-29)

10. ARCHITECTURE OF THE LUNAR BASE W. R. Sims (Princeton U.) p 73–81 refs (See N64-13711 05-29)

11. SOME LUNAR RESOURCES J. Green (North Am. Aviation) p 83–95 refs (See N64-13712 05-29)

12. THE MANNED ORBITAL SPACE STATION J. L Friend (North Am. Aviation) p 97–100 (See N64-13713 05-29)

13. GENERAL PRINCIPLES OF BIOLOGICAL REGENERATION FOR LUNAR BASE LIFE SUPPORT R. H. Mattoni (North Am. Aviation) p 101–109 refs (See N64-13714 05-16)

14. ALGAL PHOTOSYNTHETIC GAS EXCHANGERS R. D. Gafford (Martin-Marietta Corp.) p 111–117 (See N64-13715 05-16)

15. ENVIRONMENTAL CONTROL DEVELOPMENT AND LUNAR BASE SUPPORT MODULES D. M. Perry (NASA, Manned Spacecraft Center, Houston, Tex.) p 119–126 (See N64-13716 05-16)

N64-13726 Joint Publications Research Service, Washington, D.C.

SOVIET RESEARCH IN PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS

V. S. Yemel'yanov et al 10 Jan. 1964 166 p refs Transl. into ENGLISH of 13 articles from the anthology "Metallurgiya i metallovedeniye chistykh metallov", no. 4, Moscow, Gosatomizdat, 1963 p 5–10, 18–33, 47–63, 69–109, 122–148, 160–181, and 228–242 (JPRS-22697; OTS-64-21263) OTS: $3.00

CONTENTS:

1. THE IODIDE METHOD OF REFINING ZIRCONIUM. THE TRANSFER OF NONMETALLIC ADDITIONS DURING REFINING V. S. Yemel'yanov, A. I. Yevstyukhin, and D. D. Abanin p 1–7 refs (See N64-13727 05-17)

2. THE EFFECT OF HYDROGEN AND NITROGEN ON THE CORROSION RESISTANCE OF ZIRCONIUM IN WATER AND STEAM V. N. Yemel'yanov and N. V. Borkov p 8–26 refs (See N64-13728 05-07)

3. THE FORMATION OF SCALE WITH A STRUCTURE $6ZrO_2 \cdot Nb_2O_5$ ON ALLOYS OF ZIRCONIUM WITH NIOBIUM Yu. F. Bychkov, V. A. Ivanov, and A. N. Rozanov p 27–38 refs (See N64-13729 05-18)

4. OBTAINING MOLYBDENUM SINGLE CRYSTALS AND THEIR PROPERTIES V. S. Yemel'yanov, A. I. Yevstyukhin, G. A. Leont'yev, and A. N. Semenikhin p 39–45 refs (See N64-13730 05-25)

5. INVESTIGATION OF THE DISTRIBUTION OF ADDITIONS IN NIOBIUM AFTER ZONE REFINING A. I. Yevstyukhin, V. V. Nikishanov, and I. V. Milov p 46–63 refs (See N64-13731 05-17)

6. ELECTRON DIFFRACTION AND X-RAY PHOTOGRAPHIC INVESTIGATION OF OXIDE FILMS ON NIOBIUM I. I. Korobkov, B. N. Revyakin, and K. M. Chen' p 64–78 refs (See N64-13732 05-23)

7. INVESTIGATION OF THE KINETICS OF THE OXIDATION OF IODIDE NIOBIUM REFINED BY THE ELECTRON-BEAM METHOD I. I. Korobkov, B. N. Revyakin, and K. M. Chen' p 79–96 refs (See N64-13733 05-07)

8. REACTION OF AUSTENITE CHROMIUM-NICKEL STEEL WITH LIQUID LITHIUM N. M. Beskorovaynyy, M. T. Zuyev, and V. S. Yeremeyev p 97–105 refs (See N64-13734 05-07)

9. CORROSION RESISTANCE OF IRON IN LITHIUM N. M. Beskorovaynyy, V. S. Yeremeyev, M. T. Zuyev, V. K. Ivanov, and Yu. Ya. Tomashpol-skiy p 106–117 refs (See N64-13735 05-07)

10. CORROSION RESISTANCE OF TITANIUM IN LITHIUM N. M. Beskorovaynyy and M. T. Zuyev p 118–123 refs (See N64-13736 05-07)

11. CHANGES OF PROPERTIES DURING CYCLIC THERMAL TREATMENT, DURABILITY, AND INTERNAL FRICTION OF SAP · A. I. Dashkovskiy, A. N. Rozanov, Yu. F. Bychkov, and I. D. Laptev p 124–138 refs (See N64-13737 05-18)

12. THE MECHANICAL PROPERTIES OF BERYLLIUM AFTER ZONE RECRYSTALLIZATION I. V. Milov, D. M. Skorov, and V. V. Nikishanov p 139–145 refs (See N64-13738 05-18)

13. INSTALLATION FOR THE X-RAY STRUCTURAL ANALYSIS OF RADIOACTIVE MATERIALS Yu. I. Gribanov, A. G. Karmilov, and I. A. Lednev p 146–162 refs (See N64-13739 05-23)

N64-13810 Army Missile Command, Huntsville, Ala. Directorate of Research and Development

PERSHING GUIDED MISSILE TRAINER XM-19 MARRIAGE, ENGINEERING EVALUATION AND WEAPON SYSTEM TESTS Final Report

Brimage L. Smith and John F. Gassaway 20 Dec. 1963 66 p (RT-TR-63-12; AD-426949)

Data obtained during the Composite Test Program are summarized. The program consists of marriage, engineering evaluation, and weapon-system tests performed on the Pershing Ballistic Guided Missile Trainer (GMT) S/N 002. Results of the console-trainer compatibility test indicated that the test was successful and no apparent incompatibility of equipment was noted. The marriage of GMT-P S/N 002 with the programer test station from Artillery Set No 15 was satisfactory, and all trainer systems responded correctly to commands received from ground-support equipment. The following test results are also included: (1) engineering evaluation tests—control-system test, guidance computer simulator test, static inverter test, ST-120 platform simulator test, and type X warhead presetting test; and (2) weapon-system tests—handling tests, malfunction setter test, road test, and electromagnetic compatibility test. R.T.K.

N64-13967 Library of Congress, Washington, D.C. Aerospace Information Div.

COMMUNICATIONS NETWORKS. PART II: DESIGNATIONS AND ABBREVIATIONS

17 Dec. 1963 36 p

(AID-P-63-123; AD-426847) OTS: $3.60 ph, $1.28 mf

Translations and definitions are given for Soviet acronyms, abbreviations, and basic model numbers used in the field of communications networks. R.T.K.

N64-14054 Oak Ridge National Lab., Tenn.

FUEL CYCLE COSTS FOR A PLUTONIUM RECYCLE SYSTEM

F. E. Harrington, E. D. Arnold, D. C. Brater, D. A. Douglas and A. L. Lotts et al 20 Jan. 1964 38 p refs

(Contract W-7405-eng-26)

(ORNL-3501) OTS: $1.00

The costs of the chemical and metallurgical steps in the fuel cycle for large desalination reactors are estimated. Both capital and operating costs are presented at varying plant capacities for a zircaloy-clad fuel element containing depleted uranium and recycled plutonium as the oxides: UO_2-0.5% PuO_2. The chemical steps are reported at throughputs of 1, 10, and 30 short tons of uranium per day; and the metallurgical or facrication step at throughputs of 1, 3, 5, and 10 tons per day. The total estimated cost of all the chemical and metallurgical steps drops from $51.17 to $14.68 per kilogram of uranium as the cycle throughput is increased from 1 to 10 tons of uranium per day. All steps decrease in cost as plant capacity is increased, with the most impressive decrease in the irradiated assembly processing step, which decreases from $26.19 to $4.10 to $2.07 per kilogram of uranium as throughput is changed from 1 to 10 to 30 tons of uranium per day. Author

N64-14108 Radio Corp. of America, Bethesda, Md. Data Systems Center

RAPID IDENTIFICATION AND INTERPRETATION TECHNIQUES

Richard L. Krumm and Alfred J. Farina, Jr. Griffiss AFB, N.Y., Inform. Process. Lab., Nov. 1963 133 p refs

(Contract AF 30(602)-2806)

(RADC-TDR-63-421; AD-426753)

This report describes an experimental investigation of the feasibility of utilizing a rapid presentation technique to improve the target-recognition performance of photo interpreters. The test imagery involved a wide variety of military targets presented at various image scales and image quality. A four-day training course administered to a group of experienced photo interpreters effected 50-percent reduction in time required to identify military targets with no loss in either accuracy or completeness. Data analysis also indicated significant interactions among interpreters' measures and such display variables as image scale, target-to-background contrast, and image complexity. Author

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-13668 ARO, Inc., Arnold Air Force Station, Tenn.

AN ANALYSIS OF SECOND-THROAT DIFFUSER PERFORMANCE FOR ZERO-SECONDARY-FLOW EJECTOR SYSTEMS

J. H. Panesci and R. C. German Arnold Eng. Develop. Center, Dec. 1963 65 p refs

(Contract AF 40(600)-1000)

(AEDC-TDR-63-249; AD-426336)

A theoretical and experimental investigation was conducted to determine a method for predicting the starting pressure ratio for a zero-secondary-flow ejector system having a second-throat diffuser. The effects of second-throat contraction, location, and length on the ejector starting characteristics were investigated, and a method for predicting second-throat diffuser performance was developed using one-dimensional conservation equations. A comparison of both hot and cold flow data with the developed theory is presented. Good agreement between experiment and theory is obtained for both long and short second-throat diffusers. For example, the short second-throat theory deviated from the short second-throat experimental data by a maximum of 10.2 percent with an average deviation of 3.3 percent. Author

N64-13805 Air Force Systems Command, Wright-Patterson AFB, Ohio Aeronautical Systems Div.
FORCE BALANCE DETERMINATION OF INLET PERFORMANCE FOR ADVANCED VEHICLE APPLICATIONS TO ORBITAL VELOCITIES USING INTERNAL DRAG MEASUREMENTS
Paul H. Kutschenreuter, Jr. Sep. 1963 34 p refs Presented at Sci. and Eng. Symp., Wright-Patterson AFB, Ohio, 18–19 Sep. 1963
(ASD-TDR-63-701; AD-426728)

This paper is directed at the problem of determining the performance levels of supersonic–hypersonic combustion inlet models. Previous approaches to this problem are discussed, and a method involving force balance determination of the internal drag is proposed. Results of a computational procedure formulated for calculating inlet performance levels from measured internal drag values are presented. Effects of chemical reactions and exit flow profile nonuniformity are accounted for. Levels of anticipated accuracy, using this technique, are shown to be adequate for present applications over a Mach number range of 8 to 25. Author

N64-13835 Hydronautics, Inc., Laurel, Md.
VISCOUS EFFECTS ON BALANCED JETS IN GROUND PROXIMITY
C. C. Hsu 48 p refs Fort Eustis, Va., Army Transportation Res. Command, Oct. 1963
(Contract DA-44-177-TC-845)
(TRECOM-TR-63-59; TR-241-1; AD-426132)

Jets mixing and standing vortex generation have been particularly studied. It is found that in ground proximity the effect of jet mixing is always adverse and dominant. Results and curves which allow rapid estimation of augmentation factors, including viscous effects, are presented. Author

N64-13856 Army Missile Command, Huntsville, Ala.
BLACKBODY RADIATION TABLES
T. Roy Rowen 7 May 1963 73 p
(Sponsored by ARPA; Proj. Defender)
(TN-AMSMI-RNR-1-63; AD-418979)

Blackbody radiation values at a number of wavelengths and temperatures are presented in tabular form. The entries in the tables result from evaluation at the indicated wavelength and temperature, Planck's equation, which is

$$R = \frac{C_1}{\lambda^5} \frac{1}{\exp(C_2/\lambda T)-1}$$

where $C_1 = 1.1906 \times 10^4$ watts $-$micron^4 cm$^{-2}-$steradian^{-1}, $C_2 = 1.4388 \times 10^4$ micron $-^\circ$K, T is in degrees Kelvin, and λ is in microns. This equation represents the monochromatic radiant intensity at a particular wavelength from a perfect radiator maintained at the indicated temperature. The problem was programed for a digital computer, and the values presented (in the tables) were machine calculated. Most of the data are also presented graphically. R.T.K.

N64-14063* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC INVESTIGATION OF NOZZLE HINGE MOMENTS OF A MODIFIED SATURN C-1 MODEL WITH AND WITHOUT JET FLOW
Nickolai Charczenko and Jerry L. Lowery Washington, NASA, Nov. 1963 463 p (See N63-23798 24-02)
(NASA TN D-1962 Suppl.) OTS: $6.00

Tables are presented of the pressure distributions on the external surfaces of the nozzles, base, and shrouds of a modified C-1 Saturn vehicle with and without simulated jet flow. These tables constitute a supplement to NASA TN D-1962 wherein nozzle hinge-moment coefficients, derived from the tabulated data for representative configurations, are presented as a function of various parameters. In addition, a table is presented which states the test conditions for each configuration investigated. I.v.L

N64-14086 Naval Ordnance Lab., White Oak, Md.
FIRST ORDER SLIP EFFECTS ON THE COMPRESSIBLE LAMINAR BOUNDARY LAYER OVER SLENDER BODIES OF REVOLUTION WITH ZERO PRESSURE GRADIENT
Jay M. Solomon 15 Nov. 1963 93 p refs
(NOLTR-63-85; Aerodynamics Res. Rept. 200; AD-426241)

Probstein and Elliott's analysis of the transverse curvature effect on the zero pressure gradient, constant wall temperature, laminar boundary layer is extended to first order slip flow. The effect of slip and temperature jump at the wall on boundary-layer flows is characterized by a slip parameter proportional to the ratio of molecular mean free path to boundary-layer thickness. In first order slip flow, this parameter is small. Following Probstein and Elliott, the transverse curvature effect is characterized by a transverse curvature parameter which is proportional to the ratio of boundary-layer thickness to local body radius. The present solutions are obtained as double asymptotic expansions in ascending powers of the slip parameter and the transverse curvature parameter. Author

N64-14100 Electro-Optical Systems, Inc., Pasadena, Calif.
A TABULATION OF BASE FLOW PROPERTIES FOR CONES AND WEDGES
Hartley H. King Jan. 1964 142 p refs
(Contract DA-04-495-AMC-28-(Z); ARPA Order 203-A1-63; Proj. Defender)
(EOS-RN-17; AD-426983)

A systematic tabulation of laminar base-flow properties for cones and wedges at zero angle-of-attack is presented. Results were obtained using the Chapman separated-flow model, but including the effects of the finite, initial boundary-layer profiles existing at the separation point. Results are based on a perfect gas model with $\gamma = 1.4$. The primary independent variables of the tables are the free-stream Mach number, cone or wedge half angle, and wall–stream enthalpy ratio. Data are presented showing the influence of base heat transfer and of blowing either from the body surface or from the base. A sufficient range of each independent variable is used so that one may determine the effects on the base flow due to changing each parameter individually. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-13559 France. Office National d'Etudes et de Recherches Aéronautiques, Chatillon-Sous-Bagneaux
PROBLEMS PECULIAR TO CONTROL SURFACES
C. Beatrix *In* AGARD Manual on Aeroelasticity. Vol. I, Pt. I: Structural Aspects Jan. 1961 7 p refs (See N64-13552 05-01)

On present-day aircraft and engines, the majority of failures due to flutter are primarily attributable to instability of movable control surfaces. With manual control through a direct linkage connecting the stick or rudder bar to the control surface, the control surface mass distribution about its hinge axis plays an important part in the determination of the critical flutter speed. This mass distribution is involved in what is called the "balance ratio" of the surface. Among the topics discussed are: (1) definition of "perfect" balancing of a central surface, and (2) configurations to be considered for ground testing—aircraft with manual control and aircraft with power controls. R.T.K.

N64-13561 France. Office National d'Etudes et de Recherches Aéronautiques, Chatillon-Sous-Bagneaux
PROBLEMS PECULIAR TO SMALL MODELS AND TO COMPRESSOR BLADES
R. Dat *In* AGARD Manual on Aeroelasticity. Vol. I, Pt. I: Structural Aspects Jan. 1961 14 p refs (See N64-13552 05-01)

The special problems raised in the determination of elastic, mass, and damping characteristics of small models are discussed as follows: (1) effect of an additional mass; (2) excitation without mechanical contact with the structure; (3) detection of movement amplitudes without mechanical contact; (4) electrodynamic methods; (5) inertia and stiffness compensation; (6) excitation through the attachment; and (7) determination of natural shapes by addition of masses. R.T.K.

N64-13562 Aerolab Development Co., Pasadena, Calif.
THE INFLUENCE OF POWERED CONTROLS
David Benun *In* AGARD Manual on Aeroelasticity. Vol. I, Pt. I: Structural Aspects Jan. 1961 48 p ref (See N64-13552 05-01)

The inclusion of a powered control system in an airframe can influence its dynamic characteristics and render more difficult their prediction by analysis, due to one or both of the following: (1) the difference between the character of the restraint afforded by the powered control system and that supplied by the manual control system; and (2) the existence of possible couplings between the powered control surface and airframe motions, due to the action of the various sensing devices or to structural deformations which give rise to actuator inputs, and hence, surface motions. These couplings can be considered "internal" couplings, as opposed to the "external" couplings resulting from control-surface response to aerodynamic and inertial hinge moments, which also arise from airframe motions. The following topics are also considered: (1) impedance of manual control systems; (2) impedance of powered control systems; (3) analysis of a system with variable restraint; (4) control surface—airframe coupling elements; (5) "geared surface" method of analysis; and (6) corrective measures. R.T.K.

N64-13620 Vidya, Inc., Palo Alto, Calif.
THEORETICAL AERODYNAMICS OF FLEXIBLE WINGS AT LOW SPEEDS. I: ONE-LOBED PARAWINGS. Report Period, 15 Jan. 1962-15 Feb. 1963
Jack N. Nielsen, Anthony R. Kriebel, and Frederick K. Goodwin 1963 95 p refs
(Contract Nonr 3728(00))
(Vidya-84; AD-422736)

A complete theory of one-lobed slender parawings was obtained on the basis of a linearized slender-body boundary condition. Although the correction to the theory due to the nonlinear term in the boundary condition was significant within the framework of slender-body theory, it was thought to be a secondary numerical effect. An attempt was made to adapt the preceding analysis for one-lobed parawings to two-lobed parawings by adding the condition that the value of η (distance of parawing surface above chord plane) at the root chord be zero. Numerical solutions on this basis did not exhibit good convergence as the number of harmonics in the analysis was increased systematically from 10 to 45. R.T.K.

N64-13960 Cornell Aeronautical Lab., Buffalo, N.Y.
RESEARCH ON UNSTEADY STALL OF AXIAL FLOW COMPRESSORS Final Report [Dec. 1962-Nov. 1963]
W. G. Brady and B. R. Ludwig Nov. 1963 87 p refs
(Contract DA-49-186-AMC-13(X))
(CAL-AM-1762-S-4; AD-427072)

An experimental program is described that provided laminar boundary-layer velocity profiles near separation on a rotating cylinder in order to establish the proper criterion for separation of a quasi-steady boundary layer. The cylinder was shrouded in order to impose an airfoil-type pressure gradient. From the profiles, it was possible to show that the criterion for the laminar separation, when the wall and separation point are in relative motion, is the simultaneous vanishing of shear and tangential velocity. In addition to the experimental program, an analytical investigation of the flow through a narrow annulus with uniform mean axial velocity was carried out on a basis of the linearized small-disturbance theory. It was found that, for a general mean swirl velocity other than that of a free-vortex type, a small disturbance flow will not remain bounded in time or axial distance downstream except under conditions which exclude flow disturbances of the rotating-stall type. I.v.L.

N64-14131 National Physical Lab., Teddington (Gt. Brit.) Aerodynamics Div.
THEORETICAL STABILITY DERIVATIVES FOR A SYMMETRICALLY TAPERED WING AT LOW SUPERSONIC SPEEDS
Doris E. Lehrian and Gillian Smart 18 Apr. 1963 14 p refs
(NPL-AERO-1063; ARC-24710; S&C-3711)

Pitching and heaving derivatives are calculated to first order in frequency for a symmetrically tapered wing of aspect ratio 4 with streamwise tips. These stability derivatives are evaluated for four Mach numbers from 1.017 to 1.250 on the basis of linearized oscillatory theory. Comparisons are made with oscillatory strip theory and steady sonic theory. Author

N64-14158 Aeronautical Research Council (Gt. Brit.)
PITCHING DERIVATIVES FOR A GOTHIC WING OSCILLATING ABOUT A MEAN INCIDENCE
H. C. Garner and Doris E. Lehrian London, Min. of Aviation, 1963 17 p refs
(CP-695; supersedes NPL-AERO Note-1010, ARC-24537)
Available from HMSO: 3s 6d

This note briefly introduces a nonlinear theory of wings in slow pitching oscillation with leading-edge separation in incompressible flow. The oscillatory lift and pitching moment become linear functions of mean incidence. Comparisons with measured pitching derivatives are made for a gothic wing of aspect ratio 0.75. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-13500 Weser Flugzeugbau G.m.b.H., Bremen (W. Germany)

OPERATIONAL AND SYSTEMS ANALYSIS AS APPLIED TO THE DEVELOPMENT OF VERTICAL TAKE-OFF, IN PARTICULAR MODERN HELICOPTERS [EINSATZ- UND SYSTEMANALYSE, ANGEWANDT AUF DIE ENTWICKLUNG VON SENK-RECHTSTARTERN, INSBESONDERE MODERNE HUBSCHRAUBER]

Christoph Fischer Sep. 1963 32 p In GERMAN

An operational and system analysis of various types of V/STOL aircraft is presented that leads to the choice of the type of V/STOL aircraft, the respective operational area, and field of service, i.e., civilian, army, air force, and navy. I.v.L.

N64-13627 Cornell Aeronautical Lab., Buffalo, N.Y.

DEVELOPMENT AND FLIGHT CALIBRATION OF A VARIABLE-DRAG DEVICE ON A VARIABLE STABILITY T-33 AIRPLANE

F. D. Newell, B. H. Dolbin, and A. E. Schelhorn Wright-Patterson AFB, Ohio, AF Flight Dynamics Lab., Nov. 1963 74 p refs

(Contract AF 33(616)-7517)

(CAL-TE-1462-F-3; ASD-TDR-62-910; AD-425705)

The criteria, design, installation, and flight calibration of a variable drag system are discussed. The system allows for variable L/D characteristics in the variable stability T-33 airplane. With this system in the special T-33, the airplane will be used to investigate the interactions between handling qualities and many drag characteristics, including very low L/D and shapes of L/D curve for high L/D ratios. Author

N64-13847 Army Transportation Research Command, Fort Eustis, Va.

HELICOPTER VIBRATION INDICATOR Final Report

Frank S. Kawalkiewicz, Eugene V. Warner, Jr., James M. Seibert, and John E. Hempstead Oct. 1963 104 p refs

(TRECOM-TR-63-44; AD-426933)

The system tested was designed to be employed on helicopters to sense, analyze, and indicate to the pilot the existing vibration characteristics of the craft, and thereby to warn him of conditions leading to possible failure. Evaluation tests indicate that the helicopter vibration indicator, as designed, is unsuitable for use on Army helicopters. Author

N64-13849 Mississippi State U., State College

THE MARVEL PROJECT. PART B: REPORT OF PRELIMINARY FLIGHT TESTING OF MARVELETTE XAZ-1

Ft. Eustis, Va. Army Transportation Res. Command Nov. 1963 25 p

(Contract DA-44-177-AMC-892(T))

(TRECOM-TR-63-66; AD-426788)

A preliminary report on the first ten flights of the Marvelette aircraft is presented. Detailed dimensions of the aircraft are given, as well as specific data concerning each of the first ten flights. Pilots' impressions are included for each flight, and the plans of future flight tests are discussed. Author

N64-13874 Lightning and Transients Research Inst., Minneapolis, Minn.

AIRCRAFT PROTECTION FROM THUNDERSTORM ELECTROMAGNETIC EFFECTS—I (FIN CAP AND RADOME ANTENNA SYSTEM LIGHTNING PROTECTION)

M. M. Newman and J. D. Robb Wright-Patterson AFB, Ohio, Electromagnetic Warfare and Commun. Lab., Mar. 1962 37 p refs

(Contract AF 33(616)-7828)

(L&T 401; ASD-TDR-62-438; AD-276641) OTS: $3.60

Reports of thunderstorm-lightning strikes to aircraft from over 700 incidents are tabulated and, although the data on jets are not yet complete, they show the greatest incidence of strikes occurs near 0° C and around 10,000 ft altitudes, with some lightning incidents at 40,000 ft. Point-of-strike frequencies are also tabulated. Applications of artificial lightning generators and model studies to determine point-of-strike probabilities and to reproduce natural lightning in-flight effects are discussed. Specific topics included are the use of HF lightning arresters to protect the antenna and radio equipment, and the use of graded resistance diverter rods to provide localized point-of-strike control. The development of radome protection is also discussed in detail with particular emphasis on foil strip protection systems and proper use of bonding wires. Author

N64-13875 Computer Engineering Associates, Pasadena, Calif.

LOW FREQUENCY INSTABILITIES OF FREE SYSTEMS [Final Report, Mar. 1962-Aug. 1963]

Robert G. Schwendler and Jack H. Hill Wright-Patterson AFB, AF Flight Dynamics Lab., Nov. 1963 128 p

(Contract AF 33(657)-8293)

(ASD-TDR-63-655; AD-426543)

This report contains an investigation of mode-interaction instabilities of aircraft. Mode interaction refers to coupling between an elastic mode and a rigid body mode of the free system. Three rather general airframe configurations are analyzed in detail. It is shown that systems which tend toward steady-state divergence are particularly susceptible to mode interaction. Also, aerodynamic damping terms can have a destabilizing effect upon a free system. The analyses show that aeroelastic systems which possess no finite-frequency elastic mode can be susceptible to a finite-frequency instability. Computer studies of several different airframe configurations are discussed. Author

N64-13878 Advisory Group for Aeronautical Research and Development, Paris (France)

FEATURES OF LARGE TRANSPORT AIRCRAFT AFFECTING CONTROL DURING APPROACH AND LANDING

W. J. G. Pinsker (Roy. Aircraft Estab.) Jan. 1963 41 p refs FRENCH Summary

(AGARD-421)

The special features affecting the low-speed control of large high-performance transport aircraft are discussed. These are shown to be largely associated with growth in size and with the trend towards configurations extending predominantly in the fore and aft direction. These 'inertially' or 'dynamically' slender aircraft, not necessarily featuring slender wings, tend to combine slow response in pitch with relatively lively behavior in roll. In the longitudinal plane, there appears

to be the possibility of increased demands on the pilot's judgment in the approach, and accuracy might best be maintained by the use of a simple director aid. Satisfactory lateral control in crosswinds depends on ($-l_v$) being kept small, on the provision of powerful and fast-responding ailerons, and possibly on roll stabilization. Author

N64-13879 Advisory Group for Aeronautical Research and Development, Paris (France)
GROUND RUN PREDICTION
D. A. Rush (Smith and Sons, Gt. Brit.) Jan. 1963 19 p
(AGARD-422)

The problem of monitoring aircraft performance during takeoff ground run and indicating whether or not the takeoff can be made safely is considered in relation to the takeoff procedure commonly employed by the operators of transport aircraft. The argument is developed that a velocity–distance criterion is the correct choice for obtaining a true monitor of performance, and that the ideal monitor should contain prediction in order to avoid delaying pilot action until a critical point in the takeoff is reached. Equipment is described that has been developed around the operational concepts outlined earlier. The equations of prediction, the component parts of the predictor, and the methods that can be employed to measure aircraft motion are described. Applications of the equipment to emergency stop, taxi, and landing are also considered. Author

N64-13880 Advisory Group for Aeronautical Research and Development, Paris (France)
SOME ASPECTS OF AUTOMATIC FLAREOUT PERFORMANCE
J. E. Nethaway (RAE) Jan. 1963 26 p refs
(AGARD-424)

The broad principles of the B.L.E.U. flareout system are explained, and some typical flight and analog computer records of autoflares are presented. The effect of wind variation is discussed. Difficulties which may be experienced include unfavorable ground effect, loss of lift from the throttling of large propeller engines, and excessive nosedown attitude during approach. Examples are shown which indicate their effect on the automatic flare. Author

N64-13881 Advisory Group for Aeronautical Research and Development, Paris (France)
THE LANDING OF ADVANCED FLIGHT VEHICLES
D. B. Seager (Lockheed Aircraft Corp.) Jan 1963 19 p
(AGARD-427)

The results of a study of some of the problems associated with landing manned, advanced flight vehicles are summarized. Means of defining satisfactory configurations were developed and used in evaluating various types of aircraft. The results of the study indicate that a suitable criterion for determining whether or not a human pilot can supply the judgments necessary to make a satisfactory landing can be related to the rate of descent at a height of 50 feet above the touchdown point. If rates of descent at this point (exceeding about 15 ft/sec) are required, the aircraft can be considered unsatisfactory. Based on this criterion, it is indicated that satisfactory piloted landings cannot be expected for configurations having maximum low-speed lift-drag ratios less than approximately 3.0, and in some cases values greater than this will be required. The importance of not extending gear or flaps until late in the flare maneuver is shown, and it is demonstrated that the use of small amounts of propulsive thrust during the latter phases of the flare can significantly improve landing characteristics. P.V.E.

N64-13882 Advisory Group for Aeronautical Research and Development, Paris (France)
HORIZONTAL LANDING TECHNIQUES FOR HYPERSONIC VEHICLES
Robert G. Hoey (USAF) Jan. 1963 17 p
(AGARD-428)

The terminal approach and landing techniques presently being used for the X-15 hypersonic research vehicle are described. The development of these techniques and some flight test results are also discussed. The effects of wing loading, lift–drag ratio, visibility, handling qualities, speed brakes, and trim changes are analyzed as they pertain to low L/D landings of the X-15 and other hypersonic configurations. The use of an in-flight landing simulator to provide pilot training and maintain pilot proficiency is emphasized. Author

N64-13885 Naval Air Test Center, Patuxent River, Md.
FLIGHT TEST EVALUATIONS OF AIRPLANE DYNAMIC LONGITUDINAL STABILITY IN THE LOW ALTITUDE HIGH SPEED REGION
Thomas M. McPherson and Kenneth W. Weir Mar. 1963 28 p
(AD-427696)

Requirements for a low-altitude, high-speed dynamic stability investigation and the aerodynamics involved are discussed, along with the location and facilities of the test site in relation to the investigation. Special test instrumentation, airplane modifications, and flight-test techniques are covered. Test results are discussed, and figures are presented to illustrate the problem encountered on one of the test airplanes. Possible solutions to the problem are given. Author

N64-13902 Advisory Group for Aeronautical Research and Development, Paris (France)
VTOL/STOL AIRCRAFT. BIBLIOGRAPHY 2: FIRST SUPPLEMENT 1961/62
G. Bock, H. G. Klug, and H. Spintzyk, comps. Jun. 1963 121 p refs

This bibliography covers the literature published during the years 1961–1962. It comprises all available publications related to problems in the field of V/STOL. The different fields of V/STOL are divided into the following: general studies, aerodynamic problems, stability and control in hovering and transition flight, powerplants, test techniques, atmosphere, operational problems, and loads and construction. C.L.W.

N64-13925 Dornier-Werke G.m.b.H., Friedrichshafen (W. Germany)
CONTROL OF VTOL-AIRCRAFT IN HOVERING FLIGHT [DIE REGELUNG VON VTOL-FLUGZEUGEN IN SCHWEBEFLUG]
G. Schweizer, H. Seelmann, and H. Weischedel 23 Sep. 1963 39 p refs In GERMAN Presented at the Wiss. Ges. für Luft- und Raumfahrt Meeting, Munich, 1963

The operation of an automatic pilot for hovering of a VTOL aircraft is investigated from an analytical standpoint. This analysis includes the unavoidable nonlinear effects of the control system. These nonlinearities arise mainly from the limitation of the available thrust. The investigation and the corresponding simulator test result in extremely varied stability conditions, which are due to the prevailing nonlinearity and the control setting. It was noted that a certain control setting resulted in excellent limited stability and an overall poor stability. Since this latter condition cannot necessarily be detected by experimental means, an analytical stability analysis of every automatic pilot is necessary. A method for such an analysis is discussed. Also, the linearized aerodynamic force and moment

equations are applied in investigating the dynamic behavior during transitory flight. The destabilizing effect of the deflection of the lifting thrust is considered. In addition, the findings from an investigation of nonlinearized-controlled transitory flight are illustrated. Trans. by I.v.L.

N64-13934 Advisory Group for Aeronautical Research and Development, Paris (France)
THE CASE FOR VARIABLE GEOMETRY
A. Wadkovsky (RAC) Apr. 1963 25 p
(AGARD-437)

The case for the variable-geometry wing is discussed, primarily from the viewpoints of design and cost. Also discussed are such items as maintenance, structural complexity, flutter, weight penalty, and external stores arrangement. A comparison is made between two designs which are identical except that one has a fixed wing and the other a variable-geometry wing. Author

N64-13997 Mississippi State U., State College
THE MARVEL PROJECT, PART A: THE MARVELETTE AIRPLANE BACKGROUND AND DESCRIPTION
Glenn D. Bryant Ft. Eustis, Va., Army Transportation Res. Command, Nov. 1963 32 p refs
(Contract DA-44-177-AMC-892(T))
(Aerophys. Res. Rept.-45; TRECOM-TR-63-54; AD-426130)

This report discusses an aerodynamic research aircraft, the Marvel, which is being designed to explore the problem areas inherent in STOL fixed-wing aircraft. As an interim step toward refinement of the Marvel design, a test bed aircraft, the Marvelette (XAZ-1), has been designed, built, and flown. This report presents the background history of the Marvel and the description of the Marvelette. Author

N64-14008 Hydronautics, Inc., Laurel, Md.
VISCOUS AND FORWARD SPEED EFFECTS ON UNBALANCED JETS IN GROUND PROXIMITY
C. C. Hsu Ft. Eustis, Va., Army Transportation Res. Command, Oct. 1963 42 p refs
(Contract DA-44-177-TC-845)
(TRECOM-TR-63-60; Tech. Rept. 241-2; AD-426178)

This is an interim report on a theoretical investigation of the flow of air jets in ground proximity. A previous report presented a theory which included the effects of viscosity on a two-dimensional wall jet. The theory was found to be adequate for the hovering mode. This report extends the theory to include the cases of forward velocity and small angular displacements in hover. The theory indicates that the vortices or vortex-type flow induced by the viscosity of the air jets is of some importance to the stability of the annular jet ground effect machine. The investigation is continuing with experiments to confirm the assumed vortical flow pattern. Author

N64-14041 Western Electric Co., Inc., Laureldale, Pa.
PRODUCTION ENGINEERING MEASURE: MECHANIZATION OF SEMICONDUCTOR DEVICES 2N559-2N1094 Quarterly Progress Report No. 23, 1 Jul.-30 Sep. 1963
M. N. Reppert [1963] 55 p
(Contract DA-36-039-SC-72729)
(AD-425828)

The current status of the program includes the following: Modifications to transistor processing and production equipment for Nike X are underway. Refinements were completed on the platform lead welding machine with installation and testing of new component positioning nests. A significant improvement was made in closure welding machine efficiency by improving electrode holders and the electrode design. Optical studies were made of tip and probe motion, and a means was found for measuring the motion. Measurements in the 10^{-5}-inch range were made. A study of the germanium diffusion process revealed that slice-to-slice uniformity of diffusion parameters can be improved markedly by using another boat design. Refinement of the silicon dioxide coating and the strip evaporation and alloying operations continues. The only definite improvements for either operation is in evaporator alloying. I.v.L.

N64-14088 David Taylor Model Basin, Washington, D.C. Aerodynamics Lab.
RESULTS OF A VTOL PROPELLER-TYPE AIRCRAFT TESTED IN THE SUBSONIC WIND TUNNEL IN A HIGH-SPEED CONFIGURATION
Millard J. Bamber Nov. 1963 17 p refs
(DTMB-AERO-1062; AD-426234)

The ability of a propeller to develop a force perpendicular to the axis of rotation is the basis for a VTOL aircraft that appears to be capable of hovering and, at the same time, to be superior to existing types of VTOL aircraft in high-speed performance. Low-speed wind-tunnel test results for a model indicated a lift-drag ratio of 8 with propellers windmilling in the high-speed configuration. For existing VTOL aircraft, the maximum lift-drag attained in a high-speed configuration is about 5. Author

N64-14141 United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH ON METHODS FOR PRESENTING HANDLING QUALITIES CRITERIA FOR UNSTABLE SYSTEMS
James W. Clark and David P. Miller Nov. 1963 40 p refs
(UAR-B175)

The experimental portion of the study was conducted in the Sikorsky VTOL Aircraft Flight Simulator using a contact analog display. The operator was required to perform a pursuit tracking task in which his control inputs were introduced through an unstable system simulated on an analog computer. Optimum control sensitivity was selected for a range of unstable system dynamic characteristics, and a numerical operator rating of the system was recorded. Measurements of root-mean-square tracking error and integral of absolute value of control displacement were also made during a portion of the study. Both second-order (spring-mass-dashpot) systems and third-order (VTOL aircraft pitch attitude control) systems were investigated. The results show that establishment of handling qualities criteria on complex-plane plots is feasible for both of these systems. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics, and 29 Space Sciences.

N64-13706 Lockheed-California Co., Burbank
THE SHAPE OF THE MOON: A SPECIAL REPORT
L. Larmore *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 29-30 (See N64-13701 05-01)

To determine the shape of the moon, two annular eclipses were photographed. The first occurred July 31, 1962. Seventeen photographs were taken from a site about 100 miles east of Dakar in northern Africa. The second occurred January 25, 1963. It was photographed fully from a site about 600 miles from Johannesburg in southern Africa. Equipment included a heliostat and a 55-ft focal length mirror. Author

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-13568 Joint Publications Research Service, Washington, D.C

CONCERNING THE EFFECT OF MINOR PARAMETERS ON THE STABILITY OF TYPICAL AUTOMATIC CONTROL SYSTEMS 1 (INSIDE CIRCUIT)

B. G. Sirazitdinov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 14–31 refs (See N64-13565 05-01) OTS: $3.00

The effect of additional sources of inertial lagging on the stability of the inside circuit of automatic control systems is analyzed. Considerable attention is given to the qualitative regularities of this effect. The nature of the change in the stability range of the inner circuit, depending on the extent of compensation furnished by the power amplifier when the latter is an EMU (amplidyne), is described. Author

N64-13570 Joint Publications Research Service, Washington, D.C.

SYNTHESIS OF AN AUTOMATIC SYSTEM WITH A DIGITAL CONTROLLING MACHINE

A. P. Litvinov *In its* News of Higher Educ. Inst. Min of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 40–51 refs (See N64-13565 05-01) OTS: $3.00

The synthesis of an automatic system is described in which a digital machine serves as a comparator. Equations are derived to connect the parameters of the system with the assumed indexes of quality (the value of the steady error and the value of the margin of stability of a closed system). A relationship is established which makes it possible to determine the maximum allowable period for the readout of data from the digital machine. Author

N64-13587 General Precision, Inc., Little Falls, N.J. Kearfott Div.

GENERAL PURPOSE AC MOTORS Technical Information for the Engineer, No. 2

1 Jan. 1963 33 p 3d ed.

General information concerning a.c. motors is presented. Subjects discussed include voltage and frequency applications, duty cycle, induction motors, capacitor start–capacitor run motors, three-phase motors, starting torque, replacing d.c. motors, synchronous motors, hysteresis synchronous motors, two-phase servomotors, explosion-proof motors, and thermoprotectors. P.V.E.

N64-13599 Ford Instrument Co., Long Island City, N.Y. Nuclear Develop. Div.

EMITTER MATERIALS STUDY. THERMIONIC ENERGY CONVERTERS Final Technical Report

M. Silverberg et al 31 Dec. 1962 69 p refs

(Contract Nonr-3696(00))

(AD-403362)

An experimental program was conducted on selected emitter materials to determine their potential for use in low-temperature thermionic energy converters. One oxide emitter and four different dispenser types were evaluated in parallel plate and cylindrical geometry in both glass and metal ceramic construction. With respect to power density, the various dispenser–emitter types showed suitable and reasonably similar performance. Performance degradation was reversed in some of these diodes and its mechanism explored and explained. Author

N64-13643 Lockheed Missiles and Space Co., Palo Alto, Calif.

NEW CATHODE-ANODE COUPLES USING NONAQUEOUS ELECTROLYTE Second Annual Report, Oct. 1962–Sep. 1963

H. F. Bauman, J. E. Chilton, W. J. Conner, and G. M. Cook Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Oct. 1963 110 p

(Contract AF 33(616)-7957)

(RTD-TDR-63-4083; AD-425876)

The properties of a lithium–silver chloride cell using a nonaqueous electrolyte were studied, and sealed cells of 5-amp-hr nominal capacity were fabricated and tested. Nonaqueous electrolytes were formed with additions of $AlCl_3$ and LiCl to propylene carbonate (PC) and nitromethane (NM). An improved lithium deposit was obtained from the NM system and from mixed solutions of NM and PC. Mechanical fastening techniques were used to assemble multiple electrodes to terminals. Transient polarization measurements showed that increased lithium resistance occurs with reduced cell capacity on long-term cycling. The study of the lithium–silver chloride cell system led to the development of cells which operate at a current density of 1 to 2 ma/cm^2 at 2.4 to 2.6 v, and yield an energy density of 20 w-hr/lb at this rate. The charge–discharge cycle which was obtained indicated that the cells are reversible and operate as a secondary battery. R.T.K.

N64-13679 Joint Publications Research Service, Washington, D.C.

THE CONTROL SYSTEM FOR THE 2.6-m TELESCOPE

N. S. Zhurkin, V. M. Konshin, and G. L. Bruk *In its* New Methods in Astronomy 10 Jan. 1964 p 19–23 (See N64-13676 05-01) OTS: $3.00

The control system of the 2.6-m telescope includes the following principal instruments: (1) a central control panel, providing for the automatic and semiautomatic setting of the reflector in accordance with prescribed coordinates; (2) a computer instrument which computes the components of the corrections for mean refraction and flexure of the telescope and the mounting of the telescope with respect to hour angle and declination, computes solutions to the problem of transforming equatorial coordinates into azimuthal coordinates for synchronization of the motion of the telescope and dome, and determines the position angle necessary for the motion of attachments; (3) a stable-frequency oscillator which ensures

the daily control of the telescope with respect to hour angle during the observation of stars and the control of the telescope by means of a lunar-planetary drive during the observation of planets and the moon; (4) an auxiliary panel which concentrates the elements of semiautomatic control for all mechanisms of the dome; and (5) auxiliary control apparatus situated on the observers platform for focusing, etc. P.V.E.

N64-13681 Joint Publications Research Service, Washington, D.C.
THE CONTROL SYSTEM OF THE RM-700 TELESCOPE
Yu. A. Belyayev, T. S. Gerasimova, Z. V. Dravskikh, N. N. Mikhel'son, V. S. Sumin et al *In its* New Methods in Astronomy 10 Jan. 1964 p 34–42 refs (See N64-13676 05-01) OTS: $3.00

A double-control system for a 700-mm reflector telescope is described. It consists of the following: (1) semiautomatic control by the switches on one or two semiautomatic control panels—the position of the telescope is read at the panels, and for each of the coordinates there is a two-reading selsyn connection operating in an indicator regime; the clock motor is a synchronous motor fed from a quartz clock; and (2) automatic control by means of an electronic digital control apparatus. P.V.E.

N64-13682 Joint Publications Research Service, Washington, D.C.
THE SYSTEM OF AUTOMATIC CONTROL AND POINTING OF AN AZIMUTHAL TELESCOPE
Yu. A. Sabinin and P. V. Nikolayev *In its* New Methods in Astronomy 10 Jan. 1964 p 43–55 refs (See N64-13676 05-01) OTS: $3.00

The automatic tracking equipment used on an azimuthal mounted star interferometer is discussed. The equipment employs two autonomous two-coordinate servomechanisms: (1) an approximate control position servomechanism operating jointly with a coordinate transformer; and (2) a photoelectric servosystem for automatic guidance that performs the direct tracking of the star image in the optical field of the guide. The photoelectric servosystem acts as a correcting apparatus, compensating the errors of the approximate control system. An analog-type transformer is used for transformation of equatorial coordinates into azimuthal coordinates and employs rotating transformers. P.V.E.

N64-13683 Joint Publications Research Service, Washington, D.C.
AUTOMATIC COMPENSATION FOR THE SAGGING OF STELLAR TELESCOPES
G. I. Goreva, Yu. A. Sabinin, P. V. Nikolayev, and A. V. Shumakher *In its* New Methods in Astronomy 10 Jan. 1964 p 56–75 ref (See N64-13676 05-01) OTS: $3.00

The problem of creating devices which compensate for the deformation (sagging) of the tube of a telescope is discussed along with several methods for obtaining this compensation. P.V.E.

N64-13755 General Dynamics Corp., San Diego, Calif.
HIGH-TEMPERATURE VAPOR-FILLED THERMIONIC CONVERTER Final Report, 15 Mar. 1962-15 Sep. 1963
R. Skoff Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., 3 Jan. 1964 105 p refs
(Contract AF 33(657)-8563)
(RTD-TDR-63-4190; AD-426882)

The operating characteristics of plasma converters utilizing bare uranium-zirconium carbide as the emitting surface were determined as a function of operational lifetime. The emitter design was cylindrical in a size representative of that expected in a space thermionic reactor. The electrode spacing varied from 0.040 in. early in the program to 0.012 in. The primary objective of the program was to evaluate the converter performance as a function of lifetime and to determine the failure mechanism on those converters which no longer demonstrated useful power levels. An operational lifetime of 3,000 hr was considered a reasonable goal. Electrically heated, as opposed to fission-heated, converters were selected as the most economical method of fulfilling these objectives. Author

N64-13766 General Motors Corp., Indianapolis, Ind.
INVESTIGATION OF CAPILLARY EMITTER THERMIONIC CONVERTERS [Final Report, 15 May 1961-15 Aug. 1963]
D. L. Dresser, J. D. Dunlop, H. Huber, R. Le Bihan, V. L. Hill et al Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Sep. 1963 206 p refs
(Contract AF 33(616)-8299)
(ASD-TDR-63-865; AD-419140)

A random-current theoretical model is formulated to describe the emission of ions and electrons from a capillary thermionic emitter. Extensive experimental results from monocapillary and multicapillary devices are shown to be in good agreement with the theory. Practical power densities of 5 to 15 w/cm^2 were obtained between 1900° and 2100° K. A modified capillary emitter in which no cesium flow is required was also investigated and found to agree with the random current model. Ion-current measurements, high-frequency oscillations, and spectroscopic data are used to interpret the operating conditions of the capillary emitter. Technology developments are reported on the subjects of emitter fabrication and chemical vapor deposition. Author

N64-13819 Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science
CELL EQUALIZATION TECHNIQUES [Final Report]
Peter J. Whoriskey Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Dec. 1963 36 p refs
(Contract AF 33(657)-8749)
(RTD-TDR-63-4187; AD-427070)

The work program included, but was not limited to, theoretical and experimental determination of a reliable method of cell equalization on charge and elimination of cell reversal on discharge. It also embraced applied research on the equalizer and antireversal semiconductor devices with sufficient evaluations to determine that the method is reliable and practical. Two experimental sets of ten cell Ni-Cd batteries, provided with stabistor protection, were prepared. These cells were of 20-ampere-hour capacity and were to be discharged to a 75% depth. Author

N64-13898 Radio Corp. of America, Burlington, Mass. Aerospace Systems Div.
MULTISYSTEM TEST EQUIPMENT Sixth Quarterly Interim Technical Report [1 Jul.-30 Sep. 1963]
31 Oct. 1963 174 p refs
(Contracts DA-36-034-AMC-0194Z and DA-36-034-ORD-3650Z)
(ATE-MTE-5; AD-422470)

This report discusses design approaches and progress made during the sixth quarter of the program. Included are: reliability, maintainability, value engineering, and human

engineering analyses; generation breakdowns, design consideration for electronic, hydraulic, electrical, and mechanical equipment; nonstandard-parts common assemblies lists; result of environmental testing of racks and blowers; and evaluation and description of the programing effort.

Author

N64-13903* Electro-Optical Systems, Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT TECHNIQUES FOR FABRICATION OF SOLAR CONCENTRATORS Final Report, 1 Nov. 1960-31 Oct. 1961
M. A. Pichel 27 Dec. 1961 261 p
(NASA Contract NAS7-10; Amend. 2)
(NASA CR-55322; EOS-1587, Final) OTS: $17.00 ph, $8.03 mf

All-metal lightweight solar concentrators are being produced through refinements in the technique of electroforming and through the development of new techniques and methods for using electroforming. Specific topics include: electroforming studies, techniques, and controls; development of master fabrication techniques; solar concentrator development, including design and fabrication of small-scale samples and full-size 60-in.-diameter concentrators; and the evaluation and testing of solar concentrators. Author

N64-13920 Air Force Systems Command Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROSTATIC IGNITION IN CARBURETOR-TYPE ENGINES
Ye. N. Nevstruyev 23 Sep. 1963 14 p Transl. into ENGLISH from Automob. Prom. (Moscow) no. 1, 1962 p 17-20
(FTD-TT-63-822; AD-425592)

The electrostatic system of ignition was investigated. Quantitative values of the electrical indices of the system were obtained. The voltage developed by the electrostatic generator remained almost constant within a broad interval of the number of turns of the engine. The electrostatic generator is almost insensitive to shunting resistance, and therefore the engine spark plugs can be mounted under less rigid temperature conditions; this lowers the possibility of incandescent ignition, lessens the wear on the spark-plug electrodes, and cuts down the amount of deposit of lead salts on the insulators. In addition, the electrostatic ignition generator eliminates the possibility of interruptions in the working of the spark plugs when they are temporarily dirty. In general, the operation of the generator is simple. One of the more serious shortcomings of the generator is the presence of compressed gas in the body for which special packing is required; this complicates the design and increases its cost. R.T.K.

N64-13935* Monsanto Chemical Co., St. Louis, Mo.
DEVELOPMENT OF IMPROVED SINGLE CRYSTAL GALLIUM PHOSPHIDE SOLAR CELLS Quarterly Report No. 2, 12 Sep.-12 Dec. 1963
W. O. Groves and A. S. Epstein [1963] 63 p refs
(NASA Contract NAS3-2776)
(NASA CR-55311) OTS: $6.60 ph, $2.09 mf

Single-crystal gallium phosphide has been prepared by epitaxial deposition on single-crystal gallium arsenide using hydrogen chloride in an open-tube vapor transport process, with excess phosphorus and either gallium or gallium phosphide sources. Crystal growth rate, structure, and purity are discussed. Doping with tellurium and zinc has been demonstrated. Solar-cell characteristics measured at room temperature have generally fallen into two categories: (1) high open-circuit voltage and low short-circuit-current densities; (2) low open-circuit voltages and high short-circuit currents. In the former group of cells, and open-circuit voltage of 1.18 volts has been achieved with a short-circuit-current density of ~0.1 ma/cm^2. In the latter category, cells having a short-circuit-current density as high as 5 ma/cm^2 have been obtained with open-circuit voltages around 0.7 volts. These cells have their main spectral response at wavelengths of the order of 0.7μ whereas cells of category (1) respond more to the band edge absorption. Author

N64-13958 Battelle Memorial Inst., Columbus, Ohio
MULTIFUELED THERMAL-ENERGY-CONVERSION SYSTEMS Fifth Quarterly Progress Report, 1 Jul.-30 Sep. 1963
H. R. Hazard and D. E. Roop [1963] 16 p
(Contract DA-36-039-SC-90838)
(AD-427134)

A small steam boiler sized for a 150-watt power source was evaluated with charcoal, wood, and cow dung as fuel. Satisfactory combustion and boiler efficiency were obtained with heat absorption rates from 2 to 8 kw th. Startup periods were 5 to 10 minutes, depending upon the technique and fuel. A second boiler, of minimum size and weight, was designed. Author

N64-13985 General Instrument Corp., Newark, N.J. Thermoelectric Div.
SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH Quarterly Report No. 3, 1 Sep.-1 Dec. 1963
15 Dec. 1963 32 p
(Contract AF 33(657)-10335)
(AD-426687)

A solar, flat plate, thermoelectric generator consists of a collector plate with an optically selective coating, small size semiconductor thermoelements, a radiator plate, and a support structure. Panels 4 in. X 4 in. passed specified sinusoidal vibration testing. These panels were based on a support-structure concept designated as the "integral reinforced plate," in which radiator and collector plates have their edges bent to give structural reinforcement. A number of thermal cycling tests have been conducted up to a maximum of 6000 cycles. Several of the panels tested had no observable resistance changes. Other panels had changes of no more than 6%. A test of a flat-plate panel using thermal storage was conducted. Author

N64-13993 Marquardt Corp., Van Nuys, Calif.
INVESTIGATION OF THE CURRENT DENSITY LIMITATIONS IN A THERMIONIC CONVERTER Technical Summary Report, 1 Mar.-31 Oct. 1963
Coleman Kaplan [1963] 49 p refs
(Contract Nonr 3738(00))
(Rept. 25114; AD-425930)

A pulsed-discharge measurement technique was used to obtain current-voltage characteristics for a cesium thermionic converter. This experimental technique consists of (steady-state or pulsed) operation at a high-current level, followed by rapid switching to a lower output current, where the measurement is made. Ions formed during the high-current operation provide space-charge neutralization at the lower output current, so that space-charge limitation of the output is not present during the measurement. Comparison of the pulsed-discharge data with the steady-state current-voltage characteristic and with the Boltzmann line allows measurement of the electron transport losses (due to space-charge and plasma resistance) normally present during steady-state operation. Author

N64-13994 Cook Electric Co., Dayton, Ohio Inland Testing Labs.
INVESTIGATIONS LEADING TO THE DEVELOPMENT OF THE OPTIMUM METHOD(S) FOR CHARGING SEALED NICKEL-CADMIUM BATTERIES Third Quarterly Progress Report, 1 Apr.-13 Sep. 1963
I. F. Luke and R. L. Koesters [1963] 144 p
(Contract DA-36-039-SC-90823)
(AD-426220)

Experiment designs, test data, analysis, and results for investigation of constant potential charging at 75°, 125°, −10°, and −40°F for cells at initial states of charge of 0% and 66% are presented. Additional test data and analyses on constant current charging are also presented. The experiments include test variables of ambient cell temperature, charging period, charging potential, percent overcharge, initial state of charge, cell size, and discharge rate depending upon the type of charging method employed. Cells of type BB 412( )/U and BB 440 ( )/U were used in this investigation. Author

N64-14030 United Aircraft Corp., Windsor Locks, Conn. Hamilton Standard Div.
MODULAR DESIGN OF IMPROVED SOLAR CONVERTERS Seventh Quarterly Progress Report, 1 Dec. 1962-28 Feb. 1963
William A. Moriarty [1963] 38 p
(Contract DA-36-039-SC-87461)
(HSER-2667; AD-419909)

Three important tests were conducted during this period: (1) a temperature gradient test of the prototype module, (2) a molded shingle assembly shear test, and (3) a current-versus-voltage output of the active module. Relative to the Special Warfare conceptual design, drawings of a markedly different, more advanced array were completed. A wiring layout and calculations for the electrical design of the active 5-watt module were developed which indicate the number of cells per series string, total number of cells, electrical output, and physical size. Light transmission tests were performed on the materials which were subjected to ultraviolet and sunlight exposure. Author

N64-14084 National Research Council of Canada, Ottawa Div. of Mechanical Engineering
AERODYNAMIC PERFORMANCE OF A TRACTION TURBINE SUITABLE FOR A GAS TURBINE LOCOMOTIVE
U. Okapuu Natl. Res. Labs., 13 Feb. 1963 52 p refs
(MT-50; NRC-7775)

A two-stage, low-reaction, traction turbine suitable for a gas turbine locomotive powerplant was tested under unheated inlet conditions over a range of speeds and pressure ratios. The aerodynamic performance characteristics are presented in some detail. The swallowing capacity and efficiency of the turbine were found to be somewhat below the expected figures. A number of changes are suggested on the strength of the test results. Author

N64-14095 Republic Aviation Corp., Farmingdale, N.Y.
RESEARCH INVESTIGATION OF HYDRAULIC PULSATION CONCEPTS Second Quarterly Progress Report [1 Jun.-31 Aug. 1963]
F. H. Pollard et al 31 Aug. 1963 51 p
(Contract AF 33(657)-10622)
(RAC-933-2; AD-416130) OTS: $5.60

The design of a rotary pulsating generator or alternator was completed. The alternator is basically a rotary plate valve in which the porting between rotor and stator occurs at the lapped interface where these elements engage in sliding contact. Design studies of a three-piston hydraulic motor using unrectified three-phase flow were also completed. The "in-line" and "radial" piston configurations were studied. The "radial" configuration simplifies the crankshaft design because a single throw may be used. The three piston, three phase motor operates as a synchronous motor, the speed being determined by the pulsation frequency. The derivation of the characteristic equations and electric equivalents of a constant pressure, flow demand, pulsating hydraulic system is complete. This system was chosen because the combination of a constant pressure, flow demand source with a closed center valve provides the most desired system for a majority of the areas in which a pulsating hydraulic system will be applied. The miniaturized system has been completed and test investigation is in progress. Author

N64-14170 Kaman Aircraft Corp., Colorado Springs, Colo. Kaman Nuclear Div.
INVESTIGATION OF THE FEASIBILITY OF AN AIRCRAFT-OIL ANALYSIS SYSTEM FOR OPERATIONAL USE IN THE FIELD, PHASE II [Technical Report, Jul. 31, 1962-May 31, 1963]
Vernon Peckham, Phil Jessen, and Richard Vogel Nov. 1963 65 p refs
(Contract DA-44-177-TC-789)
(TRECOM-TR-63-55; AD-428108) OTS: $6.60

Atomic absorption spectrometry and neutron activation analysis were evaluated as the best methods for development into field measurement equipment for oil analysis. Statistical studies on R1820 engine-oil analysis data showed the need for more precise data. An experimental in-flight metal detector was designed and built. Author

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-13421 Joint Publications Research Service, Washington, D.C.
CORROSION STABILITY OF TITANIUM ALLOYS JOINED BY DIFFUSION WELDING
G. K. Kharchenko and L. N. Yagupol'skaya *In its* Selections on Titanium and its Alloys from Avtomat. Svarka 30 Dec. 1963 p 25-26 ref Transl. into ENGLISH of p 90 (See N64-13417 05-01) OTS: $0.75

The corrosion stability of joints of titanium alloys, made by diffusion welding, exposed to 5% hydrochloric acid was investigated. The corrosion resistance of the welded joint of the alloy did not differ from the stability of the basic metal. Increasing the welding time to more than 5 minutes at the optimum pressure did not influence the corrosion properties of the joint. R.T.K.

N64-13644 Arctic Health Research Center, Anchorage, Alaska
COLOR REMOVAL FROM SURFACE WATERS BY CARBON FILTER
D. J. Baumgartner Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Oct. 1963 8 p refs
(AAL-TDR-62-37; AD-427168)

A small carbon filter was investigated to determine the effectiveness of removing color from surface waters at remote Air Force radar sites in Alaska. The raw water was characterized by color ranging from 50 to 90 units, pH near 6, temperature 5° C, and low turbidity. When using carbon with a particle size high enough to provide low pressure losses, the color removed was less than 50 percent. With powdered, activated carbon, pressure losses and carbon carryover caused the system to be considered unacceptable even though color removal was high. Author

N64-13698 Joint Publications Research Service, Washington, D.C.

REACTION OF MOLYBDENUM WITH TITANIUM CARBIDE

V. N. Yeremenko and T. Ya. Velikanova *In its* Transl. from Poroshkovaya Met. [Kiev, v. 3] No. 5, 1963 8 Jan. 1964 p 1–9 refs (See N64-13697 05-01) OTS: $0.75

The reaction of molybdenum with titanium carbide was investigated throughout the interval of composition, and a phase diagram of the Mo-TiC system was constructed. Data of X-ray and microscopic investigations of cast, sintered, and annealed alloys and also data concerning the melting points of cast and vacuum sintered alloys are presented. The Mo-TiC quasi-binary system was found to be of the eutectic type with a limited number of solid solutions on a titanium carbide base and molybdenum base. R.T.K.

N64-13700 Joint Publications Research Service, Washington, D.C.

NITRIDING ALUMINUM POWDER AND DUST TO PRODUCE ALUMINUM NITRIDE

Yu. D. Repkin and G. V. Samsonov *In its* Transl. from Poroshkovaya Met. [Kiev, v. 3] No. 5, 1963 8 Jan. 1964 p 15–26 refs (See N64-13697 05-01) OTS: $0.75

Optimal systems of producing aluminum nitride from aluminum dusts were investigated, and the following systems are recommended: (1) When producing aluminum nitride in a nitrogen flow from aluminum dust by means of external heating, the temperature must be 800° C. After the start of the self-conducting reaction, which is accompanied by a sharp temperature rise in the reaction zone, the time at that temperature should be 30 to 40 minutes. During the reaction, to avoid inflow of oxygen from the yield side of the system, the quantity of nitrogen gas should be regulated by means of a gas valve. Yield of aluminum nitride in this case amounts to 90% to 95%. (2) When producing nitride from aluminum powders, the temperature should be taken up to 1000° C by means of external heating, whereupon, starting at 600° C, the rate of temperature rise should not exceed 5 deg/min. The time of exposure at that temperature should not be less than 4 hours. Nitride yield when nitriding powders of aluminum with particle sizes of 45 to 250 microns will amount to 50% to 65%. R.T.K.

N64-13728 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF HYDROGEN AND NITROGEN ON THE CORROSION RESISTANCE OF ZIRCONIUM IN WATER AND STEAM

V. N. Yemel'yanov and N. V. Borkov *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 8–26 refs (See N64-13726 05-01) OTS: $3.00

The effects of additions of hydrogen and nitrogen in zirconium metal on its corrosion resistance in water vapor are investigated. Zirconium was prepared with various predetermined amounts of hydrogen or nitrogen using a special alloying apparatus which is described. The tests of the specimens with hydrogen additions in steam at 350° at a pressure of 170 atm show that corrosion resistance is gradually reduced as the hydrogen content increases. Tests of the specimens with nitrogen additions show that zirconium with a nitrogen content as low as 0.007 w/o cannot be considered a corrosion resistant material in superheated steam (400° C) at 280 atm or in steam (350° C) at 170 atm since these specimens could not withstand tests lasting much more than 100 hours. The corrosion resistance of specimens with the same nitrogen content was considerably increased in steam (300° C) at 88 atm, however, since the specimens lasted 4000 hours. A comparison of these results shows that nitrogen reduces corrosion resistance of zirconium much more than hydrogen. M.P.G.

N64-13733 Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THE KINETICS OF THE OXIDATION OF IODIDE NIOBIUM REFINED BY THE ELECTRON-BEAM METHOD

I. I. Korobkov, B. N. Revyakin, and Chen' Khe-Min *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 79–96 refs (See N64-13726 05-01) OTS: $3.00

This paper reports the results of research on the oxidation kinetics of niobium of high purity in the temperature range of 350° to 1200° C at intervals of 20 to 30 degrees. Data on the relation of the oxidation rate of niobium to the oxygen pressure for temperatures of 400°, 625°, and 1000° C are also reported. Niobium was refined by the iodide refining method and remelted by an electron beam in oxygen, and the kinetics of oxidation were studied by the method of continuous weighing. C.L.W.

N64-13734 Joint Publications Research Service, Washington, D.C.

REACTION OF AUSTENITE CHROMIUM-NICKEL STEEL WITH LIQUID LITHIUM

N. M. Beskorovaynyy, M. T. Zuyev, and V. S. Yeremeyev *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 97–105 refs (See N64-13726 05-01) OTS: $3.00

Austenite chromium-nickel steel was tested in liquid lithium at 800° C in a reaction vessel made of technical iron. Interaction of lithium with chromium-nickel steels was intercrystalline in nature, and the depth of corrosion reached 2.78 mm/yr. Mechanical properties were also changed; specific elongation and yield strength decreased. It was established that the content of nickel, chromium, silicon, and tungsten in these alloys also decreased, i.e., in liquid lithium leaching of these components of chromium-nickel steel occurred. A rapid drop of plastic properties was also observed in one steel. Chromium stainless steels were found to be more stable in lithium when alloyed with molybdenum, tungsten, and niobium. It was found that the transfer of chromium and nickel into liquid lithium solution was greatly reduced upon testing 1Kh18N9T steel. Mechanical properties of 1Kh18N9T steel changed very little after testing in liquid lithium. C.L.W.

N64-13735 Joint Publications Research Service, Washington, D.C.

CORROSION RESISTANCE OF IRON IN LITHIUM

N. M. Beskorovaynyy, V. S. Yeremeyev, M. T. Zuyev, V. K. Ivanov, and Yu. Ya. Tomashpol'skiy *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 106–117 refs (See N64-13726 05-01) OTS: $3.00

Corrosion tests were conducted on industrial iron and on iron remelted in 10^{-1} to 10^{-2} mm Hg vacuum. A significant

effect was found on diffusion of lithium. During testing in lithium the surface layer of iron dissolved. The dissolution occurred predominantly along the grain boundaries, and it increased with increase of temperature and with duration of tests. During the testing of vacuum fused iron in lithium the decrease in hardness also occurred. C.L.W.

N64-13736 Joint Publications Research Service, Washington, D.C.

CORROSION RESISTANCE OF TITANIUM IN LITHIUM

N. M. Beskorovaynyy and M. T. Zuyev *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 118–123 refs (See N64-13726 05-01) OTS: $3.00

Tests were conducted on technical titanium and a titanium aluminum alloy in liquid lithium. Changes in weights of the samples were observed after testing. Both the technical titanium and the titanium aluminum alloy demonstrated satisfactory stability in lithium at 800° C in the course of 100 hours. Titanium was found to absorb dissolved gases causing lowering of plasticity and the formation of surface films of increased hardness. Changes in composition caused drastic lowering of the strength and the plasticity of the titanium aluminum alloy after testing at 1000° and 1200° C. C.L.W.

N64-13762 Aerospace Corp., El Segundo, Calif. Labs. Div.

MATERIALS AND STRUCTURES: ELECTROCHEMISTRY OF SOLIDS Semiannual Technical Report, 1 Jan.–30 Jun. 1963

T. S. Lee and W. H. Childs 20 Nov. 1963 12 p refs
(Contract AF 04(695)-169)
(TDR-169(3240-21)TR-1; SSD-TDR-63-323; AD-427250)

New electrochemical techniques for the study of solids were applied to iron and nickel in solid solution in potassium iodide. The electroreductions of these ions were found to require no overpotential, in contrast to the large overpotentials required for the corresponding reductions in aqueous solution. These results show that metal ions in solid environments are sometimes more reactive than the same ions in common liquid solvents. It was found that finely divided organic compounds in a matrix of solid salt hydrate can be reduced electrochemically. The types of compounds reduced were quinones, azo compounds, disulfides, aliphatic halogen compounds, and compounds containing conjugated double bonds. The reductions of some compounds, such as anthracene, required smaller overpotentials than did the corresponding reductions in any liquid solvent previously investigated. Author

N64-13811 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center

THE VIBRATIONAL SPECTRA OF ETHYLENIMINE AND ITS ALKYL SUBSTITUTES

Yu. N. Scheinker, E. M. Peresleni, and G. I. Braz 15 Mar. 1963 12 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 29, 1955 p 518–522
(RSIC-5; AD-299094) OTS: $1.60

Results of studies on the spectra of the Raman effect and infrared absorption, as well as basicity constants for ethylenimine, 2-methylethylenimine, 2,2-dimethylethylenimine, N-isopropylethylenimine, N-2-butylethylenimine, and N-cyclohexylethylenimine are presented. The following were noted: (1) The vibration of the trinomial cycle in the compounds investigated was not characteristic because it is located in the region of vibrations of the C—C and C—N bonds. (2) The stress in the trinomial cycles of 1,2 alkyl-enimines led to an increase in the frequencies of the valence vibrations of external C—H bonds, a decrease of the characteristic frequency of N—H bonds, and to a decrease of the basicity. (3) The stress in the cycle did not reflect on the value of molecular refractions in the series of compounds investigated. R.T.K.

N64-13907 Atomic Energy Commission, Washington, D.C. Div. of Technical Information

SELECTED MEASUREMENT METHODS FOR PLUTONIUM AND URANIUM IN THE NUCLEAR FUEL CYCLE

Ralph J. Jones, ed. et al 1963 433 p refs
(TID-7029) GPO: $3.50

CONTENTS:

PART I: GENERAL CONSIDERATIONS
1. INTRODUCTION p 3–9 refs
2. STANDARD REFERENCE MATERIALS p 11–23 refs
3. SAMPLING p 25–50 refs
4. BULK MEASUREMENTS p 51–58 refs
5. STATISTICS OF MEASUREMENT p 59–86 refs
PART 2: ANALYTICAL METHODS
6. URANIUM CONCENTRATION MEASUREMENT p 89–163 refs
7. URANIUM ISOTOPIC COMPOSITION MEASUREMENT p 167–305 refs
8. PLUTONIUM CONCENTRATION MEASUREMENT p 307–367 refs
9. PLUTONIUM ISOTOPIC COMPOSITION MEASUREMENT p 369–379 refs
10. SUPPLEMENTARY METHODS p 381–419 refs

N64-13946 Atomic Energy Commision, Washington, D.C. Div. of Technical Information

PHYSICAL CHEMISTRY OF MOLTEN SALTS AND SLAGS. PROCEEDINGS OF THE ALL-UNION CONFERENCE ON PHYSICAL CHEMISTRY OF MOLTEN SALTS AND SLAGS, NOVEMBER 22-25, 1960

Oct. 1963 611 p refs Transl. by JPRS into ENGLISH of "Fizicheskaya Khimiya Rasplavlennykh Solei i Shlakov", Moscow, Metallurgizdat, 1962
(AEC-TR-5948) OTS: $7.00

CONTENTS:

PART I: PHYSICAL CHEMISTRY OF MOLTEN SALTS
1. KINETICS OF ELECTRODE PROCESSES IN FUSED SALTS Y. K. Delimarskii p 1–24 refs
2. EQUILIBRIUM IN THE SYSTEM OF A METAL AND ITS FUSED SALT Y. V. Baimakov p 25–52 refs
3. THE PRESENT STATE OF INVESTIGATIONS OF THERMODYNAMIC CHARACTERISTICS OF MOLTEN SALTS N. K. Voskresenskaya p 53–67 refs
4. THE TERNARY SYSTEM OF THE CHLORIDES OF POTASSIUM, BARIUM, AND TITANIUM M. V. Kamenetskii, A. A. Kostyukov, and T. C. Hsiao p 53–67 refs
5. THE TERNARY SYSTEM OF THE CHLORIDES OF SODIUM, TITANIUM, AND BARIUM M. V. Kamenetskii, A. A. Kostyukov, and V. A. Korchakov p 75–78
6. INVESTIGATION OF THE MELTS OF CHLORIDE FLUORIDE SYSTEMS OF SODIUM, POTASSIUM, AND ZIRCONIUM A. I. Evstyukhin, V. S. Emel'yanov, and Y. G. Godin p 79–90 refs
7. FUSIBILITY DIAGRAMS OF CHLORIDE-FLUORIDE SYSTEMS OF SODIUM, POTASSIUM, AND ZIRCONIUM I. N. Sheiko, R. V. Chernov, and V. S. Kikhno p 91–97 refs
8. PROPERTIES AND STRUCTURE OF MELTS OF THE $NaF-AiF_3$ SYSTEM M. M. Vetyukov p 98–111 refs

9. THE INTERACTION OF CHLORIDES WITH CRYOLITE MELTS A. I. Belyaev, L. A. Firsanova, and M. G. Akopova p 112–122 refs

10. IONIC STRUCTURE OF EUTECTIC MIXTURES OF FUSED SALTS L. N. Antipin p 123–133 refs

11. INVESTIGATION OF SOME PHYSIOCHEMICAL CHARACTERISTICS OF MELTS OF THE SYSTEMS MCl_2-NaCl-KCl-$CaCl_2$ AND $MgCl_2$-NaCl-KCl-$BaCl_2$ K. L. Strelets and N. V. Bondarenko p 134–153 refs

12. CONDUCTANCE OF THE MELTS OF BINARY SALT MIXTURES AND ITS RELATIONSHIP TO THE PHASE DIAGRAMS B. F. Markov p 154–166 refs

13. DENSITY AND ELECTRIC CONDUCTANCE OF MELTS OF THE SYSTEMS K_2CO_3-Na_2CO_3, Na_2CO_3-Li_2CO_3 AND K_2CO_3-Li_2CO_3 G. V. Vorob'ev, S. V. Karpachev, and S. F. Pal'guev p 167–177 refs

14. SPECIFIC CONDUCTANCE OF FUSED CHLORIDES OF ALKALI METALS AND MCl-$TiCl_3$ MIXTURES R. V. Chernov and Y. K. Delimarskii p 178–184 refs

15. SURFACE TENSION OF MOLTEN SALTS N. K. Voskresenskaya, I. D. Sokolova, and E. L. Krivovyazov p 185–198 refs

16. INVESTIGATION OF FUSED SALTS BY MEANS OF RADIOACTIVE RADIATIONS A. I. Belyaev 199–205 refs

17. THERMODYNAMIC CHARACTERISTICS OF MELTS AND SOLID SOLUTIONS OF THE NaCl-KCl-$CdCl_2$ SYSTEM A. V. Storonkin, M. M. Shul'ts, and I. M. Bushueva p 216–226 refs

18. COMPLEX FORMATION IN SOLUTIONS OF FUSED SALTS AND CONCENTRATION DEPENDENCE OF THERMODYNAMIC FUNCTIONS M. F. Lantratov, A. F. Alabyshev, and A. G. Morachevskii p 227–233 refs

19. SPECIFIC FEATURES OF REACTIONS OF SALTS WITH METALS IN RECIPROCAL DISPLACEMENT SYSTEMS IN THE MOLTEN STATE A. P. Palkin and N. D. Chikanov p 234–242 refs

20. DISSOLUTION OF METALLIC MAGNESIUM IN FUSED CHLORIDES N. G. Bukum and E. A. Ukshe p 243–253 refs

21. INTERPHASE TENSION OF LIQUID ALUMINUM AT THE BOUNDARY WITH MOLTEN SALTS E. A. Zhemchuzhina and A. I. Belyaev p 254–263 refs

22. CORROSION OF IRON IN MELTS CONTAINING SULFATES AND NITRATES OF METALS OF GROUP I AND II OF THE SYSTEM OF D. I. MENDELEEV V. P. Kochergin, V. N. Savel'ev, E. F. Ivanovskaya, and E. P. Asanova p 264–277 refs

23. INFLUENCE OF THE NATURE OF CATIONS OF THE SOLVENT-SALT ON STABILITY OF THE ANIONIC CHLORIDE COMPLEXES OF BERYLLIUM M. V. Smirnov and N. Y. Chukreev p 278–288 refs

24. PROPERTIES OF ELECTRIC DOUBLE LAYER IN MOLTEN CHLORIDES E. A. Ukshe, N. G. Bukun and D. I. Leikis p 289–296 refs

25. KINETICS OF CATHODIC PROCESSES ON ELECTROLYSIS OF CALCIUM CHLORIDE WITH A LIQUID LEAD CATHODE V. V. Rodyakin p 297–303

26. INVESTIGATION OF CATHODIC PROCESSES DURING SEPARATION OF POTASSIUM AT SOLID AND LIQUID CATHODES BY ELECTROLYSIS OF MOLTEN SALTS B. I. Skirtymonskaya and M. F. Lantratov p 304–313 refs

27. CATHODIC AND ANODIC PROCESSES DURING ELECTROLYSIS OF CHLORIDE AND FLUORIDE-CHLORIDE MELTS CONTAINING ZIRCONIUM AND HAFNIUM M. V. Smirnov, A. N. Baraboshkin, V. E. Komarov, and N. A. Saltykova p 314–324 refs

28. ANODIC DEPOLARIZATION ON PRODUCTION OF SODIUM BY ELECTROLYSIS OF CHLORIDE MELTS K. Y. Grachev and B. V. Kartalov p 325–332 refs

29. ON ELECTROCHEMICAL PARTICIPATION OF THE CARBON OF THE ANODE IN THE PROCESS OF DISCHARGE OF OXYGEN-CONTAINING ANIONS V. P. Mashovets and I. M. Egorov p 333–352 refs

30. HIGH-TEMPERATURE REFERENCE ELECTRODES FOR MOLTEN SALTS: TIN-SODIUM QUARTZ ELECTRODE AND PLATINUM ELECTRODE A. A. Kolotii, Y. K. Delimarskii, and V. F. Grishchenko p 353–361 refs

31. CONTRIBUTION TO THE QUESTION CONCERNING THE RELATION BETWEEN CONTACT DIFFERENCE IN POTENTIALS AND DIFFERENCE OF ZERO CHARGE POTENTIALS OF METALS V. A. Kuznetsov and L. S. Zagainova p 362–369 refs

32. DETERMINATION OF DIFFUSION COEFFICIENTS OF ZIRCONIUM IONS IN MOLTEN SALTS BY THE CHRONOPOTENTIOMETRIC METHOD A. N. Baraboshkin, M. V. Smirnov, and N. A. Saltykova p 370–376 refs

33. CONVECTIONAL DIFFUSION IN MOLTEN ELECTROLYTES I. D. Panchenko, Y. K. Delimarskii, and G. V. Shilina p 377–382 refs

34. ELECTROCHEMICAL METHOD OF DETERMINATION OF DIFFUSION COEFFICIENTS AND HEATS OF FORMATION OF ZINC-COPPER ALLOYS IN MOLTEN SALTS D. P. Zosimovich p 383–391 refs

35. OSCILLOGRAPHIC STUDIES OF MOLTEN ELECTROLYTES A. V. Gorodyskii, Y. K. Delimarskii, and V. V. Kuz'movich p 392–403 refs

36. POLAROGRAPHIC STUDY OF THE IONS OF MANGANESE, IRON, AND TIN, WITH A BACKGROUND OF MOLTEN MIXTURES OF NaC1 + KC1 V. V. Kuz'movich and Y. K. Delimarskii p 404–416 refs

37. THE BEHAVIOR OF TITANIUM IN MIXED FLUORIDE-CHLORIDE MELTS M. V. Smirnov, N. A. Loginov, and K. A. Tsiovkina p 417–425 refs

38. SPECIFIC FEATURES OF THE BEHAVIOR OF TITANIUM DICHLORIDE IN THE MELT AND ITS ROLE DURING ELECTROLYSIS A. M. Budnevskii, H. C. Li, D. M. Chizhikov, and G. N. Zviadadze p 426–437 refs

39. EQUILIBRIUM POTENTIALS OF ZIRCONIUM AND HAFNIUM IN CHLORIDE MELTS AND MIXED FLUORIDE-CHLORIDE MELTS M. V. Smirnov, V. E. Komarov, and A. N. Baraboshkin p 438–448 (Page 445–448 lacking)

PART TWO: PHYSICAL CHEMISTRY OF MOLTEN SLAGS

40. SOME PROBLEMS OF THERMODYNAMICS AND KINETICS OF REACTIONS IN THE METAL-SLAG SYSTEM O. V. Travin, and L. A. Shvartsman p 449–470 refs (Pages 449–460 lacking)

41. ACID-BASE PROPERTIES OF SILICATE MELTS AND RELATIVE MOBILITY OF IONS V. I. Malkin p 471–480 refs

42. DIFFUSION COEFFICIENTS IN MOLTEN SLAGS V. I. Musikhin, and O. A. Esin p 481–491 refs

43. MEASUREMENT OF COEFFICIENTS OF AUTODIFFUSION OF SODIUM ION IN THREE-COMPONENT SILICATE MELTS V. I. Malkin and V. M. Mogutnov p 492–501 refs

44. PHYSICOCHEMICAL PROPERTIES OF METALLURGICAL SODIUM SLAGS A. A. Fofanov p 502–510 refs

45. THE EFFECT OF CALCIUM OXIDE IN ACIDIC SLAGS SATURATED WITH SILICA ON THE DISTRIBUTION OF OXYGEN, MANGANESE, AND SILICON BETWEEN METAL AND SLAG N. M. Chuiko p 511–525 refs

46. THE STATE OF METALS IN SLAGS OF NONFERROUS METALLURGY V. L. Kheifets and S. E. Vaisburd p 526–534 refs

47. CONCERNING THE FORMS IN WHICH ARSENIC AND ANTIMONY ARE PRESENT IN THE OXIDATIVE SLAGS M. L. Sazonov, and L. A. Shvartsman p 535–542 refs

48. THE EFFECT OF ZINC OXIDE ON PHYSICOCHEMICAL PROPERTIES OF FERROCALCIUM SILICATES D. M. Chizkikov, Z. F. Gulyanitskaya, V. P. Schastlivyi, R. N. Petrova, and L. I. Blokhina p 543–553

49. DETERMINATION OF SOME THERMODYNAMIC FUNCTIONS OF ZINC SULFIDE IN THE ZnS-FeS-Cu_2S SYSTEM V. N. Nesterov and V. D. Ponomarev p 554–558

50. THERMODYNAMIC CHARACTERISTICS OF OXIDES DISSOLVED IN MOLTEN SODIUM METAPHOSPHATE AND BORAX Y. K. Delimarskii, V. A. Andreeva, and G. D. Nazarenko p 559–573 refs

51. ELECTROCHEMICAL STUDY OF MOLTEN SULFIDES OF HEAVY METALS A. A. Velikanov p 574–592 refs

52. POLAROGRAPHIC STUDY OF TITANIUM DIOXIDE DISSOLVED IN MOLTEN SILICATE GLASS T. N. Kaptsova p 593–598 refs

53. ELECTROCAPILLARY EFFECTS IN THE SYSTEM CRUDE IRON–SLAG B. V. Patrov p 599–601 refs

54. RESOLUTION OF THE CONFERENCE ON PHYSICAL CHEMISTRY OF MOLTEN SALTS AND SLAGS p 602–604

N64-13949 Chicago U., Ill.
PLUTONIUM CHEMISTRY SYMPOSIUM, CHICAGO, ILLINOIS, FEBRUARY 18, 1963
Winston M. Manning (Argonne Natl. Lab.) et al [1963] 42 p refs Sponsored in co-operation with Argonne Natl. Lab.

Papers presented at the symposium are entitled: (1) Plutonium—Its Beginnings; (2) The First Experiments with Pure Plutonium Compounds; (3) The Structure of Plutonium Metal; (4) Pu and All That (a description of the activities of AEC historians); (5) Nuclear Properties of Plutonium; (6) Solution Chemistry of Plutonium; (7) Dry Chemistry of Plutonium; and (8) Scale, Nuclear Economics, and Salt Water. P.V.E.

N64-14011 RAND Corp., Santa Monica, Calif.
MASS ACTION LAWS AND THE GIBBS FREE ENERGY FUNCTION
N. Z. Shapiro and L. S. Shapley Dec. 1963 59 p refs
(Contract AF 49(638)-700)
(RM-3935-PR; AD-426718)

Recent progress in computational techniques for the analysis of complex chemical systems has renewed interest in the relationship between the mass action laws, which have been traditionally employed for the computation of chemical equilibrium compositions, and the Gibbs free energy function, which until recently has generally been used only for theoretical purposes. Several attendant mathematical questions concern the existence and uniqueness of a solution to the equations arising from the mass action laws; the existence and uniqueness of a composition that minimizes the free energy; and the precise relationship between the two. In this paper, the problems are formulated, both from the mathematical and chemical viewpoints. Mathematical tools unavailable in Gibbs' time are employed in an attempt to answer the questions posed. Some applications of the results are given. Author

N64-14018 Union Carbide Research Inst., Tarrytown, N.Y.
THE REACTION OF ACTIVE NITROGEN WITH GRAPHITE
Harold W. Goldstein Dec. 1963 12 p refs
(Contract DA-30-069-ORD-2787)
(Tech. Rept. C-19; AD-426744)

The reaction of microwave-activated nitrogen with graphite was studied in the temperature range 1694° to 2365° K. Cyanogen, hydrogen cyanide, and carbon dioxide were the reaction products condensed in traps at liquid nitrogen temperature. Activation energies of 17.6 ±0.9 kcal $mole^{-1}$ and 19.2 ±2.7 kcal $mole^{-1}$ were calculated for the production of cyanogen with TSX graphite and AGOT graphite, respectively. The production of hydrogen cyanide and carbon dioxide is ascribed to the presence of impurities in the nitrogen and graphite. Author

N64-14019 Union Carbide Research Inst., Tarrytown, N.Y.
BIBLIOGRAPHY ON ANALYTICAL CHEMISTRY RELATING TO BORIDES, CARBIDES, AND NITRIDES OF GROUP IV AND V ELEMENTS
Mary R. Bateman, Gloria J. Mc Kinley, G. H. Clewett, and H. F. Wendt, comps. [1963] 44 p refs
(Contract DA-30-069-ORD-2787)
(Tech. Rept. C-20; AD-426742)

The bibliography covers a period from 1944 through 1963, and is accompanied by a subject index. P.V.E.

N64-14072 Joint Publications Research Service, Washington, D.C.
SYNTHESIS OF CERTAIN NEW THIOLS AND THEIR ACETYL DERIVATIVES
R. M. Lagidze and R. N. Akhvlediani 28 Jan. 1964 7 p refs Transl. into ENGLISH from Soobshcheniya Akad. Nauk Gruzin. SSR (Tiflis), v. 31, no. 3, Sep. 1963 p 577–581
(JPRS-22953; OTS-64-21417) OTS: $0.50

A description is presented of new thiols and their acetyl derivatives obtained from the following chloroesters: 2,5-dimethyl-3-chloro-4-acetoxyhexadiene-2,4; 3-chloro-1-acetoxybutane; and 1-chloro-4-acetoxybutane. By reacting these chloroesters with potassium hydrosulfide, the following thioalcohols and their acetyl derivatives were obtained: 2,5-dimethyl-3-mercapto-4-acetoxyhexadiene-2,4; 3-mercapto-1-acetoxybutane; 1-mercapto-4-acetoxybutane; 2,5-dimethyl-3-acetylthio-4-acetoxyhexadiene-2,4; 3-acetylthio-1-acetoxybutane; and 1-acetylthio-4-acetoxybutane. The structural formulas and basic indices of the derived compounds are presented in table form. P.V.E.

N64-14075 Joint Publications Research Service, Washington, D.C.
SYNTHESIS OF 2,5-DISUBSTITUTED QUINUCLIDINES
Ye. Ye. Mikhlina et al 31 Jan. 1964 18 p refs Transl. into ENGLISH from Zh. Obshch. Khim. (Moscow), v. 35, no. 12, [1962] p 3852–3857
(JPRS-23020; OTS-64-21451) OTS: $0.50

The synthesis of 2-methyl-5-hydroxyquinuclidine starting with 2-methylisonicotinic acid, isolation of two isomeric forms of alcohol, and the synthesis of two isomeric forms of 2-methylquinuclidine-5-carboxylic acid starting with 2-methyl-5-ketoquinuclidine are discussed. P.V.E.

N64-14097 Aerojet-General Corp., Sacramento, Calif. Solid Rocket Plant
RESEARCH AND DEVELOPMENT IN SUPPORT OF THE POLARIS PROGRAM. TASK VI: DEVELOPMENT OF IMPROVED RESIN SYSTEMS FOR FILAMENT-WOUND STRUCTURES [Bimonthly Progress Rept. No. 3] 1 Oct.–8 Nov. 1963
19 Dec. 1963 33 p refs
(Contract NOw-63-0627-C(FBM))
(Rept. 0627-6-3; AD-426490)

This report presents final results of analyses of raw materials (amine and anhydride curing agents, epoxy resins); physical and mechanical property data collected thus far on resin systems cured with m-phenylenediamine, ethylenediamine, and 4,4'-methylenedianiline; and the statistical analysis of data for m-phenylenediamine-cured systems. Author

N64-14102 Royal Coll. of Science and Tech., Glasgow (Gt. Brit.)
Final Report, 1 Sep. 1962-30 Aug. 1963 [PREPARATION OF COMPOUNDS OF TRANSITION METALS WITH POLYHALOCARBONS AND HETEROCYCLES AS π-BONDING LIGANDS]
P. L. Pauson [1963] 17 p refs
(Contract DA-91-591-EUC-2399)
(AD-426470)

The object of the work was the preparation of compounds of transition metals with (1) polyhalocarbons and (2) heterocycles as π-bonding ligands. The preparation of the novel azaferrocenes by two routes is discussed. Further progress was made towards the incorporation of functional groups in such derivatives and with the use of polycyclic heterocycles and of compounds containing 2 or 3 nitrogen atoms in a 5-membered ring. Also discussed is the preparation of the pyrrolyl manganese and iron compounds and their simple alkyl derivatives; some account of their properties are given. Author

N64-14104 Aberdeen Proving Ground, Md. Coating and Chemical Lab.
A STUDY ON THE PREVENTION OF GALVANIC CORROSION BETWEEN MAGNESIUM AND STEEL
William H. Deaver 8 Nov. 1963 17 p
(CCL-150; AD-428004)

This work covers a survey of five methods and pretreatments that have been recommended for the prevention or reduction of galvanic corrosion between magnesium and steel. In conjunction with this, 6 primers of various types were evaluated. Where treatment before assembly can be made, only complete insulation will prevent galvanic corrosion. Where treatment before assembly is not possible, the stannate process shows promise. Author

N64-14169 Colorado U., Boulder
HALOGENOID COMPLEXES Progress Report No. 4, 1 Apr.-30 Sep. 1963
R. N. Keller [1963] 7 p refs
(Grant DA-ARO(D)-31-124-G198)
(AD-428105)

Progress reported includes the following: (1) A study at a temperature of 28° C, an ionic strength of 0.05, and with correcting the thermodynamic dissociation constant of hydrazoic acid to ionic strength 0.05, gave a value of 5.01×10^4 for the stability quotient of FeN_3^{++}. A value of 3.1×10^3 at 460 mm was obtained for the extinction coefficient of FeN_3^{++}; this value agrees well with that of Badoz-Lambling. The results obtained for the ferric azide complex was then used to interpret equilibria in mixed systems containing ferric nitrate, sodium azide, and mercuric nitrate. (2) An ingenious method was developed for isolating pure samples of the tetraphenylarsonium $[(\phi_4As)_2Cu(NCO)_4]$ and tetraphenylphosphonium $[(\phi_4P)_2Cu(NCO)_4]$ derivatives. A 1:1 water-alcohol solution of the potassium cupric cyanate complex was added to an alcoholic solution of tetraphenylarsonium chloride (or tetraphenylphosphonium chloride) and the resulting well-mixed solution was placed in the center of a thoroughly clean and dry 8-inch watch glass at room temperature. After a short time, well-formed crystals of the desired substances started growing along the periphery of the watch glass, almost an inch off the liquid, and the mother liquor, which lost its color, collected in the center. I.v.L.

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-13569 Joint Publications Research Service, Washington, D.C.
APPROXIMATE DIFFERENTIATION OF FREQUENCY-PULSE INFORMATION
R. G. Karpov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 32-39 refs (See N64-13565 05-01)
OTS: $3.00

A method and an electronic circuit are described for performing an approximate differentiation of continuous information specified in a pulse-frequency form. The operation of approximate differentiation is reduced to obtaining a new continuous sequence of pulses N equal to the difference between two sequences of pulses N_1 modeling the variation of a certain physical value x_1 (t) and N'_1, which is delayed for a finite time ΔT by the sequence N_1. Author

N64-13604 General Motors Corp., Milwaukee, Wis. AC Spark Plug Div.
DEVELOPMENT OF A SOLID STATE NEAR RECEIVER Final Report
Myrton N. Jones, Walter J. Sattler, and Harold J. Simms, Jr. Nov. 1963 163 p refs
(Contract OCD-OS-63-37)
(AD-426197)

Near receivers incorporating solid-state circuits are technically feasible. To minimize circuitry, essential receiver functions were clearly established. Circuits and components with adequate performance were compared on the basis of stability, simplicity, and cost. Those with the best combined characteristics were designed into a model. More than 30 circuits and combinations of circuits were examined before the final selection. The model receiver was assembled and tested to demonstrate electrical performance. Requirements were met and no critical mechanical or environmental effects were noted in this design. In respect to reliability, solid-state designs are anticipated to equal if not surpass electromechanical designs; although, judged on cost alone, solid state circuitry is not believed to be competitive at present. Author

N64-13639 Army Missile Command, Huntsville, Ala.
MILLIMETER TECHNIQUE EVALUATION OF GUIDANCE DATA ATTENUATION BY EXHAUST PLUMES
Augustus H. Green, Jr. 25 Sep. 1963 36 p refs
(RE-TR-63-31; AD-426419)

The interaction of a plasma (rocket exhaust) with an electromagnetic wave is related to three essential parameters: (1) the collision frequency of free electrons with neutral particles, (2) the free electron density, and (3) the frequency of the electromagnetic wave. The propagation constant is a function of the attenuation constant and the phase constant which are related to the three parameters. An analysis of these parameters is essential to achieving an understanding of signal propagation through a plasma. By measuring the attenuation constant and the phase constant at selected frequencies, the collision frequency and the electron density may be determined.

An analysis of these results indicates which types of propellants render good propagation characteristics. This report contains a development of the theory and the types of experiments which are planned or underway. Author

N64-13664 Boston Coll., Mass.
A THEORETICAL STUDY OF TROPOSPHERIC RADIOWAVE PROPAGATION Scientific Report No. 1
Rose M. Ring May 1963 88 p refs
(Contract AF 19(628)-2772)
(AFCRL-63-713; AD-426306)

A time factor $e^{i\omega t}$ is assumed, and results are expressed in terms of the modified Hankel functions of order one-third. A unified and reasonably short treatment is attempted of several problems which arise in investigating a homogeneous atmosphere, an inhomogeneous atmosphere, and superrefraction. Author

N64-13673 SFD Labs., Inc., Union, N.J.
RESEARCH AND DEVELOPMENT ON L-BAND CROSSED-FIELD AMPLIFIER CHAIN Semi-annual Report, Sep. 1963-Feb. 1963
M. Mangot and H. L. McDowell Nov. 1963 153 p refs
(Contract AF 30(602)-2533; ARPA Order 136.61)
(RADC-TDR-63-492; AD-426729)

New versions of both driver and power tubes were designed, and construction of these tubes was started. Studies were made of different magnetic circuit designs to determine how tubes could best be mounted in a phased array. It was concluded that a fixed array of permanent magnets with removable tubes made largely of nonmagnetic material is preferable to combined tube and permanent magnet packages. Initial tests were made on the incorporation of a nonreciprocal ferrite attenuator on the slow wave circuit. While these tests show promise they also indicate that a number of difficult problems must be solved to obtain a satisfactory nonreciprocal attenuator. Author

N64-13783 Tridea Electronics Corp., South Pasadena, Calif.
A STUDY AND INVESTIGATION OF THE OPERATIONS CENTRAL AN/MSQ-16 (XW-2) Final Report
P. M. Brown et al Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 193 p refs
(Contract AF 30(602)-3095)
(RADC-TDR-63-403; AD-426758)

This report describes the detailed requirements of the Operations Central AN/MSQ-16 (XW-2) equipment for the purpose of making in-flight antenna pattern measurements and to provide a general purpose facility to make spectrum signature measurements on a wide variety of radiating weapon systems. The various expected signal sources are analyzed, and the required equipment performance in terms of antenna gains and receiver sensitivities is specified. An analysis of means of providing a passive tracking capability is made, and it is concluded that an RF differencing monopulse-type tracker can provide the required angle tracking performance over the RF tuning range of 0.1 kMc to 18 kMc, with this range divided into six bands. Various receiver and calibration systems are analyzed, and it is concluded that the receiver tuning units and calibration generators should be located within the antenna pedestal. Transmission of signals to the main equipment location can then be made at IF frequencies. Author

N64-13804 Aerospace Medical Div. Aerospace Medical Research Labs., (6570th), Wright-Patterson AFB, Ohio
RESEARCH AND DEVELOPMENT ON PULSE-MODULATED, PERSONAL-TELEMETRY SYSTEMS [Report Period, Jan. 1961-Jul. 1963]
Adolf R. Marko, M. A. Mc Lennan, E. G. Correll, George Potor, and J. M. Gibson Oct. 1963 23 p refs
(AMRL-TDR-63-96; AD-425574) OTS: $0.75

The research and development undertaken on pulse-position and pulse-duration modulation for application in personal telemetry systems resulted in an improved three-channel pulse-position amplitude-modulation-telemetry system with frequency modulation in the FM band. Further experimentation resulted in a seven-channel laboratory mode using pulse-duration modulation. The seven-channel equipment allows the monitoring of the electroencephalogram, two leads of electrocardiogram, galvanic skin resistance (base resistance and specific response), respiration and body temperature, at a distance up to 300 ft. High baseline and amplitude stability are combined with low-power consumption. New microelectronic components make it feasible to reduce the size of the seven-channel transmitting unit to 3 1/2 by 2 1/4 by 1 inch, and the weight to about 200 g, without sacrificing performance. Author

N64-13806 Army Missile Command, Huntsville, Ala. Advanced Systems Lab.
AN ANALYTICAL DETERMINATION OF THE RADAR CROSS SECTION OF CERTAIN MISSILE-LIKE CONFIGURATIONS
Robert J. Chynoweth and Robert R. Boothe 13 Aug. 1963 40 p refs
(RF-TR-63-16; AD-426913)

This report is concerned with the description of the assumptions, methods, and equations used in the analytical determination of the radar cross section of various missile configurations. The method used is primarily that of physical optics. Examples, using the physical optics integral, are included. Two methods of computing the cross section are given: (1) phase addition, giving a complex pattern and, (2) random addition, giving an effective pattern. Author

N64-13807 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
MISSILE-BORNE TRACKING ANTENNA Final Progress Report for Fiscal Year 1963
James E. Howell 9 Jul. 1963 57 p
(RG-TR-63-20; AD-426932)

This task involved the development of electronically steerable, automatically self-directing, missile-borne antennas. The literature was searched, and a preliminary study was made on the use of circularly polarized antennas for producing the necessary phase shifts required in the lobing of antenna arrays. Helical antennas were used first in tests around 5,000 Mc in an effort to determine the phasing characteristics and feasibility of circularly polarized antennas. Next a cavity backed Archimedean spiral antenna and balun were designed and fabricated for 5,000-Mc operation. A logarithmic spiral antenna was also designed and fabricated for use in the developmental antenna tests. The spiral antennas were fabricated from copper-clad board by printed circuit etching techniques. Some of the problems encountered during laboratory tests were balun unbalance, radiation from the balun, and the detrimental effects of the reflected wave when using cavities. Author

N64-13864 Emmanuel Coll., Boston, Mass.
THE PROCESS OF SPEED SOUND DISCRIMINATION [TEKUSHCHEE RASPOZNAVANIE ZVUKA RECHK]
L. A. Christovich, Iu. A. Klass, and Iu. I. Kuz'min Bedford, Mass., AFCRL, Jun. 1963 34 p. refs Transl. into ENGLISH from Vopr. psikhologii (Moscow), no. 6, 1962 p 26–39
(Contract AF 19(604)-8505)
(E-T-R-63-10; AD-4245513)

Articulation movements in a rapid repetition of speech sounds were studied. It was found that 100 to 150 msec after a transition from vowel to consonant occurs in the audible signal, the articulation apparatus of the subject assumes a "consonant state." This undifferentiated state may fail to coincide with any of the consonants which are found in the given language. As new information registers, the undifferentiated state becomes more and more specified until a full correspondence with the perceived consonant is attained. The specification goes on until all information on the consonant becomes available. The above results show that articulation reflects the very mechanism by which the discriminative arrangement in the brain operates. Author

N64-13870 Army Signal Engineering Labs., Fort Monmouth, N.J.
SLOTTED CYLINDER ANTENNAS FOR RADIOSONDE SET AN/DMQ-6
Stafford W. Thompson and Elza R. Farley Sep. 1963 49 p refs
(USAELRDL-TR-2368; AD-421523)

Rocket-borne Radiosonde Set AN/DMQ-6, adapted from a balloon-borne equipment to gather the high-altitude wind and temperature data need for missile design and evaluation, requires a compact, omnidirectional antenna with good axial coverage to permit tracking of the rocket nose cone on descent as well as ascent. A helical, slotted cylinder antenna, compact enough to fit into the nose cone of the ARCAS rocket and with operation in the 1660 Mc to 1700 Mc frequency range, was developed to meet this requirement. The helical, center-fed slot, λ long and $<<\lambda$ wide at 1680 Mc, was cut in a cylinder 0.222λ long and 0.16λ in diameter. A second requirement, arising from the need to use the entire upper portion of the nose cone for sensory equipment, was satisfied by the development of a circumferentially slotted cylinder antenna. This antenna consisted of a cylinder 0.2λ in height and 0.57λ in diameter at 1680 Mc, around which four center-fed circumferential slots 0.6λ long were symmetrically placed. Both antennas proved satisfactory in engineering flight tests. Author

N64-13890 Aerospace Corp., El Segundo, Calif.
A DISCUSSION OF SPREAD SPECTRUM COMPOSITE CODES
Communications Systems Technical Report No. 3
David J. Braverman 1 Dec. 1963 49 p refs
(Contract AF 04(695)-269)
(TDR-269(4111)-9; SSD-TDR-63-306; AD-425862)

This report considers a technique known as composite code synchronization in which individual element codes of the composite can be synchronized individually. The requirement of maximum detectability of the elements and a symmetric combining function imply the use of a majority Boolean function in the formation of the composite code. The detectability of the elements decreases as the square root of the number of elements. Optimum strategies for communication and jamming imply the use of the majority Boolean function of the elements which are in cynchrony. Time averages are computed on an ensemble assumption by using a truth table in which each entry is equally probable. Author

N64-13941 National Bureau of Standards, Boulder, Colo.
THE NORMAL PHASE VARIATIONS OF THE 18 KC/S SIGNALS FROM NBA OBSERVED AT FRANKFURT, GERMANY
A. H. Brady, A. C. Murphy, and D. D. Crombie 8 Dec. 1963 34 p refs
(NBS-TN-206-1) GPO: $0.25

Observations of the normal phase variations of the 18 kc/s signals radiated from the Canal Zone and received in Frankfurt, Germany, are given in the form of monthly averages and standard deviations at 5-minute intervals. The relation between mean diurnal phase variations and the diurnal variation in path illumination is shown. The mean diurnal height change is 21 km, which is reduced to 20 km during summer and winter and increased to 22 km during the equinoxes. Short-term normal phase differences are also briefly discussed. Author

N64-14015 Lincoln Lab., Mass. Inst. of Tech., Lexington
POINTING THE LINCOLN LABORATORY BUILDING B ROOF ANTENNA IN REAL TIME USING THE CDC 160-A COMPUTER
J. D. Drinan 26 Jun. 1963 47 p refs
(Contract AF 19(628)-500)
(Rept. 62G-3; AD-410546)

A computer program has been constructed for the CDC 160-A computer which controls, in real time, the Laboratory's 30-ft telemetry antenna in tracking artificial near-earth satellites. The program accepts input orbital parameters and generates new pointing angles (and range) every eight seconds. Author

N64-14028 Lincoln Lab., Mass. Inst. of Tech., Lexington
CODING FOR TRACKING RADAR RANGING
T. C. Bartee and P. E. Wood 11 Jun. 1963 45 p refs
(Contract AF 19(628)-500)
(Tech. Rept. 318; AD-416649)

A technique for determining the range for a tracking radar to a space vehicle is described in which an uninterrupted periodic binary sequence of very long period is used to modulate the radar output. A short segment of the sequence is uniquely associated with its phase or position in the sequence. Therefore, the distance can be determined from the phase displacement between a segment transmitted and a segment received at the same instant in time. A digital correlation procedure is employed to discriminate against detection errors that occur in the received segments. The expected time required to measure the distance and the probability of computing an incorrect distance are presented for various probabilities of detection error. Modulating sequences are listed for which the probability of computing an incorrect distance is minimum. Methods of logic design are presented for the required digital circuitry. Author

N64-14091 Lincoln Lab., Mass. Inst. of Tech., Lexington
INVESTIGATION OF EFFECTS OF SURFACE DEVIATIONS ON HAYSTACK ANTENNA RADIATION PATTERNS
A. R. Dion 29 Jul. 1963 20 p refs
(Contract AF 19(628)-500)
(Tech. Rept. 324; AD-418470)

The radiation field of large apertures with phase errors is approximated by dividing the aperture into subapertures, over which the phase and amplitude are nearly constant, and by adding their field contributions. This method is applied to hypothetic Haystack reflectors, and the phase errors considered are, among others, those caused by structural deflections. Author

N64-14128 California Inst. of Tech., Pasadena Owens Valley Radio Observatory
LINEAR POLARIZATION MEASUREMENTS OF THE DECIMETER WAVELENGTH RADIATION FROM SMALL DIAMETER RADIO SOURCES
G. A. Seielstad, D. Morris, V. Radhakrishnan, and R. W. Wilson 1963 9 p refs
(Contract Nonr-220(19))
(*Its* Observations 7)

The linear polarization measurements were made during July and November 1962. At the focus of each antenna was a linearly polarized feed horn whose position angle could be set to within ±0°05. The feed horns were mounted so that rotation produced a maximum beam wobble of <0°5 and a maximum change in beamwidth of <%5. A superheterodyne receiver with an intermediate frequency of 10 mc/s was used throughout. Both sidebands were accepted. The bandwidth was 5 mc/s and a time constant of 5 sec was employed. The output was read from a mechanical integrator. Data are presented on radio sources found to be linearly polarized at 10.6-cm and 21-cm wavelengths. In addition, measurements of radio sources were undertaken at an 18-cm wavelength to investigate the effect of Faraday rotation on the plane of polarization between the wavelengths of 10.6 cm and 21 cm. I.v.L.

N64-14132 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
INFLUENCE OF A SECTOR GROUND SCREEN ON THE FIELD OF A VERTICAL ANTENNA
James R. Wait and Lillie C. Walters 15 Apr. 1963 29 p refs
(Contract PRO-61-568)
(NBS-Monograph-60) GPO: $0.25

The field of a short vertical antenna on a homogeneous round is shown to be modified by the presence of a metallic screen. The screen is taken in the form of a circular disk and a concentric sector. The modification of the field is expressed in the form of surface integrals over the disk and the sector. Extensive numerical results for these basic integrals are given, and a number of applications are illustrated. Author

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-13425 Argentina. Comision Nacional De Energia Atomica, Buenos Aires
LINEAR AMPLIFIER [AMPLIFICADOR LINEAL]
Jose R. Lorenzetti (Buenos Aires U.) and Santiago F. Pinasco 1963 14 p refs In SPANISH; ENGLISH Summary
(*Its* informe 95)

Described is a modification of a linear pulse amplifier containing only three tubes. The following characteristics were obtained: (1) gain = 1000, (2) output pulse amplitude, within its linear range = + 100 v (positive), (3) rise time = 0.10 μsec, (4) decay time = 0.1 μsec with 200 pF at the output. Author

N64-13567 Joint Publications Research Service, Washington, D.C.
CONCERNING THE PERFORMANCE OF PHOTOTUBES AT REDUCED VOLTAGE
V. M. Zhestyanikov and L. S. Grinberg *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 8–13 refs
(See N64-13565 05-01) OTS: $3.00

The precision is described with which electrical circuits containing a vacuum phototube will perform with a reduction in voltage from the network supplying current to the incandescent lamp that illuminates the phototube. An empirical formula is presented for the volt-ampere characteristic of an antimony–cesium phototube operating under a reduced voltage; equations are derived which connect the deviations of the photoelectric current with the deviations of the voltages across the phototube and with the voltage across the illuminating lamp. Author

N64-13590 General Electric Co., Schenectady, N.Y. General Electric Research Lab.
THERMIONIC CONVERTER SURFACE CONDITIONS Third Quarterly Technical Progress Report, 1 Aug.-31 Oct. 1963
V. C. Wilson Wright-Patterson AFB, Ohio, Aero. Propulsion Lab., Nov. 1963 20 p refs
(Contract AF 33(657)-10132)
(AD-423257)

This report includes a short review of the program of work being undertaken. The investigation of the operation of a parallel-plane cesium converter having an emitter of oxygen-treated tantalum and a collector of molybdenum was completed. Author

N64-13624 New York U., N.Y. Lab. for Electroscience Research
A SIMPLIFIED ANALYSIS OF THE SERIES-SHUNT FEEDBACK PAIR Scientific Report No. 7
M. S. Ghausi 9 Sep. 1963 20 p refs
(Contract AF 19(628)-379)
(Tech. Rept. 400-83; AFCRL-63-520; AD-425444)

A simplified analysis of the series-shunt feedback pair is given. It is shown that the use of a simple model for the transistors can adequately describe the behavior of the circuit; thus, involved matrix nodal or mesh equations for such circuits need not be used. The analysis is experimentally checked, and the results of gain and bandwidth show very close agreement with those predicted by the theory. Author

N64-13626 Sperry Gyroscope Co., Great Neck, N.Y.
ASTRONAVIGATION COMPUTER RESEARCH [Final Report, 4 Apr. 1961-23 May 1963]
John J. Spirito Wright-Patterson AFB, Ohio, AF Avionics Lab., Oct. 1963 135 p
(Contract AF 33(616)-8268)
(CA-4221-0089-1; ASD-TDR-63-337; AD-423704)

A biaperture ferrite element has been developed for use in memories and registers in the temperature range from −55° C to +125° C. The element is employed in: (1) the NDRO, random-access electrically-alterable program memory, (2) the NDRO random-access data memory, and (3) the DRO registers in the arithmetic unit. The feasibility of using single-driver current pulses to accomplish multiple computer operations has been demonstrated. This technique results in high reliability (low number of drivers) and low power consumption. A new method of developing basic computer timing pulses has been demonstrated in the sequential switch, which develops basic timing

for computer operations while employing few active components. High signal-to-noise ratios have been maintained on both registers and memories through the use of cancelling cores which effectively cancel shuttles. Author

N64-13638 Compagnie Générale de Télégraphie Rans Fil, Paris (France)
RESEARCH ON ONE MILLIMETER C.W. CARCINOTRON Technical Report No. 5
Oct. 1963 7 p
(Contract AF 61(052)-629)
(RADC-TR-63-551; AD-426353)

Investigation and construction of an O-type carcinotron, with the following electrical requirements, are discussed: center frequency of 300 kmc/s, bandwidth of 5% to 10%, power output of 1 watt cw, high voltage of 10 kv (max), efficiency of 0.5%, and focusing by electromagnetics. Tube experiments, improvements of electron guns, and tube construction are discussed. P.V.E.

N64-13666 Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.
USE OF THE AN/DPN-66 TRANSPONDER IN A RANGE CALIBRATION SATELLITE Final Report of Study Program
F. Sharp 21 Nov. 1963 166 p refs
(AFCRL-63-912; AD-426345)

This report discusses the suitability of the AN/DPN-66 C-Band Transponder for operation in a range calibration satellite, the prime function of which is the calibration of C-band tracking and instrumentation radars. The report covers the tasks, the procedures used, the results obtained, the conclusions drawn therefrom, and the resultant suggested or applied modifications to the transponder. The electromagnetic compatibility tests showed that after minor modifications, the AN/DPN-66 fully complied with specifications. Life-altitude test results were favorable, with all significant problem areas resolved. Author

N64-13740 Joint Publications Research Service, Washington, D.C.
REVERSIBLE OPERATIONAL AMPLIFIER AND CHARACTERISTICS OF TRANSPORTATION NETWORK
H. Ye. Pukhov et al 3 Jan. 1964 16 p refs Transl. into ENGLISH of 2 articles from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 4, 1962 p 466–472
(JPRS-22607; OTS-64-21211) OTS: $0.50

CONTENTS:

1. REVERSIBLE OPERATIONAL AMPLIFIER H. Ye. Pukhov p 1–6 (See N64-13741 05-09)
2. DETERMINATION OF THE CHARACTERISTICS OF A TRANSPORTATION NETWORK BY THE METHOD OF SUCCESSIVE ANALYSIS OF VARIATIONS O. O. Bakayev, S. V. Branovyts'ka, V. S. Kikhalevych, and N. Z. Shor p 7–13 refs (See N64-13740 05-09) OTS: $0.50

N64-13741 Joint Publications Research Service, Washington, D.C.
REVERSIBLE OPERATIONAL AMPLIFIER
H. Ye. Pukhov *In its* Reversible Operational Amplifier and Characteristics of Transportation Network 3 Jan. 1964 p 1–6 (See N64-13740 05-09) OTS: $0.50

Diagrams of the electric circuits and analyses of the operation of the following are included: (1) irreversible operational amplifier; (2) reversible operational amplifier; and (3) conventional designations of the reversible solution elements—multiplier–divider, inverter, and integrator–differentiator. The mathematical operations are realized by means of an electronic simulating device if, along with the elements of directed action, there are elements for which the feeding of voltages to any of the poles would cause the appearance of corresponding voltages at other poles. These elements can be obtained on the basis of the proposed reversible operational amplifier. R.T.K.

N64-13742 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF THE CHARACTERISTICS OF A TRANSPORTATION NETWORK BY THE METHOD OF SUCCESSIVE ANALYSIS OF VARIATIONS
O. O. Bakayev, S. V. Branovyts'ka, V. S. Mikhalevych, and N. Z. Shor *In its* Reversible Operational Amplifier and Characteristics of Transportation Network 3 Jan. 1964 p 7–13 refs (See N64-13740 05-09) OTS: $0.50

In order to automate the preparation of economic tables and their introduction into electronic digital computers, a method and algorithm for the analysis of a transportation network, for the determination of characteristics which can be utilized in solving fundamental transportation problems, were developed and are described. Using the method, the time required for preparation of problems can be greatly shortened, possible errors are excluded, and matrices of almost infinite dimensions can be composed. Author

N64-13769 General Electric Co., Palo Alto, Calif. Traveling Wave Tube Product Section
APPLIED RESEARCH OF BEAM INTERACTION STRUCTURES FOR TRAVELING WAVE TUBES [Final Report, Apr. 1962–Apr. 1963]
C. E. Enderby Wright-Patterson AFB, Ohio, Electron. Technol. Lab., May 1963 34 p
(Contract AF 33(657)-8360)
(ASD-TDR-63-569; AD-414554)

The experimental tube was built such that both modes that can exist on a circuit were coupled independently through separate waveguides, to allow testing of each mode. The tube was tested with both a hollow beam and a solid beam. The tube gave 20 db gain in the ++ mode and about 3 db gain in the +− mode. The power obtained in the ++ mode was about 15 kw with the hollow beam and about 8 kw with the solid beam. The perveance was slightly different for the two beams, so both of these represent about 0.5 kw maximum, and the hollow beam produced 4 kw maximum. The conclusions that can be reached from this program are that the ring plane circuits are very well suited to the high-frequency high-power region as both an oscillator and an amplifier. They can have high gains and high efficiencies with large peak power and average power capabilities. Author

N64-13776 Aerospace Corp., El Segundo, Calif. Labs. Div.
A GENERAL ANALYSIS OF THE FALSE-LOCK PROBLEM ASSOCIATED WITH THE PHASE-LOCK LOOP
Walter A. Johnson 2 Oct. 1963 14 p refs
(Contract AF 04(695)-269)
(TDR-269(4250-45)-1; SSD-TDR-63-222; AD-427155)

An approximate analysis is made of a false lock in a phase-lock loop as determined by the gain-phase characteristics of the phase-lock loop. The solutions presented enable calculation of false-lock frequencies if the open-loop phase characteristic is known. A simple design criterion is suggested to permit the design of a loop with no stable locks other than the desired lock frequency. Author

N64-13829 Army Signal Research and Development Lab., Fort Monmouth, N.J.

ACCELERATED LIFE TEST INDICATORS FOR RELIABLE SEMICONDUCTOR DEVICES

Bernard Reich Aug. 1963 15 p

(USAELRDL-TR-2362; AD-422356)

The usefulness of accelerated life testing for long- and short-term evaluation of semiconductor devices is discussed. Short-term accelerated testing has been found useful in evaluating germanium and nonplanar silicon transistors. For planar devices, longer term accelerated testing is deemed necessary, and the conditions for device failure are more critical. Modes of failure must be clearly identified before meaningful extrapolations are made. Author

N64-13858 Harvard U., Cambridge, Mass. Cruft Lab.

RESEARCH IN ELECTROMAGNETIC SCATTERING AND ANTENNAS A SUMMARY Final Report

Ronald W. P. King 15 Apr. 1963 18 p refs

(Contract AF 19(604)-4118)

(AFCRL-63-189; Sci. Rept. 17, Ser. 2; AD-425735)

The two major fields of research have been the development of a new theory of arrays in which account is taken of mutual coupling between elements and a comprehensive investigation of antennas coupled to open wire lines. Research has also been completed on a traveling-wave antenna, on surface waves and periodic structures, and on the Fresnel gain of aperture antennas. Work on scattering has been limited to the study of back scattering from a ribbon. In this report, a brief review of the above research is presented. I.v.L.

N64-13871 Army Signal Engineering Labs., Fort Monmouth, N.J.

STATIC AND DYNAMIC PERFORMANCE OF MICROPOWER TRANSISTOR LINEAR AMPLIFIERS

R. A. Gilson, O. Pitzalis, W. Kiss, and J. D. Meindl Sep. 1963 64 p refs

(USAELRDL-TR-2386; AD-422578)

Silicon planar transistors which exhibit junction reverse currents smaller than 10^{-9} amp and common emitter current transfer ratios greater than 50 for collector currents of 10^{-6} amperes are now available. An optimum design technique for the application of these devices in linear broadband amplifiers has been devised. A salient feature of this technique is that it provides a unified approach to the d.c. and large-signal a.c. design of a micropower amplifier. Subject to initial constraints, the design technique (1) provides a specified amplifier output power capability over a wide temperature range, (2) minimizes amplifier power drain, and (3) maximizes amplifier power gain. With slight modification, the optimum design technique also serves as the basis for a worst case design procedure for linear amplifiers considering transistor and resistor tolerance margins. The frequency response of micropower amplifiers can be accurately predicted on the basis of a unilateralized hybrid pi transistor equivalent circuit. Amplifier bandwidth may be significantly enhanced by means of a cascode circuit. Author

N64-13892 Michigan U., Ann Arbor Electron Physics Lab.

APPLIED RESEARCH IN MICROWAVE AND QUANTUM ELECTRONICS Interim Scientific Report No. 4, 5 Jun.-5 Oct. 1963

J. E. Boers, H. K. Detweiler, G. I. Haddad, G. Hok, G. T. Konrad et al Oct. 1963 129 p refs

(Contract AF 33(657)-8050)

(Rept. 05000-8-S; AD-423534)

Work done to date on the general program of applied research in microwave and quantum electronics is summarized. All the investigations carried out are directed toward extending the state-of-the-art. Research is theoretical as well as experimental in nature. Theoretical work is largely devoted to an investigation of low-noise phenomena and beam-plasma interactions. Experimental work is concerned with electromagnetic generation, particularly in the short wavelength regions. This includes several plasma devices, masers, and a Cerenkov radiation device. In addition, crossed-field electron guns and high-thermal-conductivity dielectric materials for high-average-power microwave tubes are studied from a theoretical as well as experimental point of view. Author

N64-13932 Duke U., Durham, N.C.

SOME EXACT RADIAL INTEGRALS FOR DIRAC-COULOMB FUNCTIONS

J. T. Reynolds, D. S. Onley, and L. C. Biedenharn [1962] 22 p refs

(Supported by Army and NSF)

(AD-427692)

The zero-energy-loss Dirac–Coulomb integrals are evaluated using the technique of contour integration. The expressions obtained have a closed analytic form, showing that these integrals are formally similar to the corresponding classical and nonrelativistic quantum-mechanical zero-energy-loss integrals, which also have exact elementary solutions. Application of the zero-energy-loss Dirac–Coulomb integrals occurs in inelastic electron scattering and similar problems. The investigation of the finite-energy-loss Dirac–Coulomb integrals requires a study of the zero-energy-loss integrals as a preliminary. Author

N64-13953 National Bureau of Standards, Boulder, Colo.

TABULATION OF PUBLISHED DATA ON SOVIET ELECTRON DEVICES

Charles P. Marsden 3 Jun. 1963 77 p

(NBS-TN-186) GPO: $0.45

This tabulation includes published data on Soviet electron devices, collected from various publications, mostly handbooks, published by the various ministries and institutes of the U.S.S.R. Information is given on the following active devices: receiving tubes, power tubes, rectifier tubes, voltage regulator tubes, current regulator tubes, thyratrons, cathode-ray tubes, microwaves tubes, transistors, diodes, phototubes and photomultipliers, flash tubes, thermocouple tubes, thermistors, strobotrons, counter tubes, discharge tubes, decatrons, light amplifiers, and basing connections. R.T.K.

N64-13962 Microwave Electronics Corp., Palo Alto, Calif.

DEVELOPMENT OF LOW NOISE TRAVELING-WAVE TUBES. PHASE III: ENVIRONMENTALIZATION Monthly Status Letter No. 23, 1 Dec. 1963-2 Jan. 1964

A. C. Ashley and W. E. Raub [1964] 9 p

(Contract NObsr-81227)

(AD-427547)

The X-band life-test tube has passed 2,300 hours of operation with only slight degradation of performance, while two S-band tubes have passed 700 hours with virtually no change of performance. One C-band tube was being environmentally tested at the end of the reporting period. This tube will be on life test during the next period. One L-band vacuum envelope of the 300-volt helix design was partially tested during the period, but it developed a grid 2-to-grid 3 short before any significant data could be obtained. Author

N64-13965 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POWERFUL KLYSTRON AMPLIFIERS
V. P. Demidov 26 Sep. 1963 8 p Transl. into ENGLISH from Vestn Protivovozdushnoy Oborony (Moscow), no. 9, 1961 p 23–25
(FTD-MT-63-91/1+2+3+4; AD-427015)

Descriptions are presented of two- and three-resonator klystrons, and the general working principles are discussed. P.V.E.

N64-14016 Lincoln Lab., Mass. Inst. of Tech., Lexington
CHARACTERISTICS AND APPLICATIONS OF SOLID-STATE OPERATIONAL AMPLIFIERS
J. N. Harris and K. E. Perry 23 Jul. 1963 69 p refs
(Contract AF 19(628)-500)
(Rept. 62G-2; AD-413473)

Recent developments in semiconductor components permit the design of operational amplifiers which rival, and in some respects exceed, the performance of conventional vacuum-tube operational amplifiers. A number of practical designs are discussed. A survey is given of some applications that have been used in analog data processing. Both linear and nonlinear feedback elements are considered. Author

N64-14073 Joint Publications Research Service, Washington, D.C.
SEMICONDUCTOR TECHNOLOGY AND MICROELECTRONICS
Ya. Fedotov 30 Jan. 1964 12 p Transl. into ENGLISH from Radio (Moscow), no. 11, Nov. 1963 p 28–31
(JPRS-22993; OTS-64-21437) OTS: $0.50

Miniaturization and increasing reliability of radio electronic apparatus, the roles of semiconductor technology in the solution of this problem, solid systems, and molecular electronics are discussed. P.V.E.

N64-14090 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
COMPATIBLE TECHNIQUES FOR INTEGRATED CIRCUITRY Eighth Quarterly Report, 1 Feb.-30 Apr. 1963
[1963] 120 p refs
(Contract AF 33(616)-8276)
(AD-426051)

Research activities in the following areas are summarized: (1) compatible thin film techniques; (2) silicon integrated circuit technology; (3) 120 Mc RF amplifier fabricated with compatible techniques; (4) audio amplifier utilized in 120 Mc AM transreceiver; (5) PNP-NPN monolithic integrated circuit technology; (6) flat package development; (7) VHF transreceiver circuit design and evaluation; and (8) digital communications system. P.V.E.

N64-14092 Bendix Corp., Davenport, Iowa Pioneer-Central Div.
RESEARCH WORK FOR FREQUENCY TEMPERATURE COMPENSATION TECHNIQUES FOR QUARTZ CRYSTAL OSCILLATORS Third Quarterly Report, 1 Jan. 1963-31 Mar. 1963
1 Aug. 1963 71 p
(Contract DA-36-039-SC-90782)
(Pub. No. 2715-63; AD-417697)

This report covers two types of temperature compensation of crystal oscillators, the varicap method and the capacitor-diode method. One of the objects of investigating various compensation circuits is to find different compensation voltage-versus-temperature characteristics to determine if there is an optimum voltage-versus-temperature characteristic that can be obtained. A graphical approach to compensation can be obtained. A graphical approach to compensation using the capacitor-diode method is discussed. Predicted and actual curves of Δ/f versus temperature are included to illustrate the accuracy of the graphical approach to compensation. The thermistor-resistor networks required for compensation are discussed along with the thermal transient problem. Aging data on temperature-compensated crystal oscillators are also shown. Author

N64-14114 Bell Aerosystems Co., Buffalo, N. Y.
DEVELOPMENT OF VISUAL SIMULATION TECHNIQUES FOR ASTRONAUTICAL FLIGHT TRAINING. VOLUME II: IMAGE ASSEMBLY TECHNIQUES FOR VISUAL SIMULATION OF ORBITING FLIGHT Technical Documentary Report, Mar. 1962- Apr. [1963]
L. Gerhardt and A. B. Johnson Wright-Patterson AFB, Ohio, Behavioral Sci. Lab., Nov. 1963 75 p refs
(Contract AF 33(616)-7802)
(AMRL-TDR-63-54, Vol. 2; AD-427318)

The various possible methods for developing a keying signal for matting control of multiple image generation were studied in an effort to determine the best technique for application to the simulation problem. A switching amplifier was developed to fill a gap existing in available high resolution equipment. A new 1 1/2-inch vidicon camera was documented for future applications in the simulation field. A modulated light beam projector was also documented for future reference. Author

N64-14120 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
QUARTZ CRYSTAL AGING EFFECTS Second Quarterly Report, 15 May-15 Aug. 1963
R. B. Belser, W. H. Hicklin, and R. A. Young 15 Aug. 1963 59 p ref
(Contract DA-36-039-AMC-02251(E))
(AD-426953)

Work was principally directed toward obtaining the remainder of the necessary commercial resonators, completing apparatus for low-frequency measurements, and fabricating the necessary resonators for the radiation and reliability studies. Aging studies of units fabricated for the observation of radiation effects and of reliability were commenced. X-ray topographic patterns of 15 units were made in a continuing effort to identify performance characteristics with topographic patterns observed. Author

N64-14121 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
AGING CHARACTERISTICS OF QUARTZ CRYSTAL RESONATORS Final Technical Report No. 8, 15 Feb. 1961-15 Feb. 1963
R. B. Belser and W. H. Hicklin 15 Feb. 1963 137 p refs
(Contract DA-36-139-SC-87407)
(AD-415412)

The objectives of this research required the fabrication of approximately 350 quartz resonators, storage of the units at a constant temperature of 85° C, and measurement of the frequency of the units to an accuracy of a few parts in 10^9. Measurements were required at the fundamental frequency and at the third and fifth overtones. An additional assignment on the measurement of the effects of pulsed radiation on the

aging of resonators was undertaken. Some additional information was obtained on cumulative effects of exposure to gamma radiation on the aging of quartz resonators. X-ray diffraction methods employing the techniques of X-ray topography and source image distortion were introduced for the study of strains, twinning, and other defects in quartz resonator blanks. Author

N64-14130 Aeronautical Research Council (Gt. Brit.)
A TIME-DIVISION ANALOGUE MULTIPLIER FOR CORRELATION MEASUREMENTS AND MIXING AT FREQUENCIES UP TO 100 KILOCYCLES PER SECOND
R. F. Johnson London, Min. of Aviation, 1963 33 p refs (CP-685; supersedes NPL-AERO-1030, ARC-23977) Available from HMSO: 6s

A circuit for a time-division multiplier is described that is capable of accepting signals from zero frequency to 100 kc/s. Preamplifiers and associated circuits are described that enable the multiplier to be used for the measurement of a wide range of parameters encountered in the turbulence and noise field. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see*: 06 Auxiliary Systems.

N64-13447 Advisory Group for Aeronautical Research and Development, Paris (France)
APN-114 MANUAL AND AUTOMATIC LANDING SYSTEM: TERMINAL CONTROL THEORY, SYSTEM INTEGRATION CONCEPTS, FLIGHT TEST RESULTS, AND FUTURE DEVELOPMENTS
D. D. Farnum and J. W. Montoooth (Autonetics) Jan. 1963 40 p refs
(AGARD-425)

The theory and operation of the APN-114 Automatic and Manual All-Weather Landing System are described. Results of flight test programs with the Convair TF-102A and the Boeing 707-80 are presented. Possible system building blocks, including advantages and disadvantages, are noted. Also, areas which require additional research and development are briefly discussed. Author

N64-13650 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
ANTENNA FLIGHT SIMULATOR Final Progress Report for Fiscal Year 1963
James E. Howell 9 Jul. 1963 44 p
(RG-TR-63-19; AD-426257)

This project concerns the development of an antenna flight simulator, a system which will automatically plot the expected field strength of a missile antenna system throughout flight. The antenna flight simulator consists of servosystems which receive the antenna look angle, round angle, and slant range information directly from a computer, and which direct a model positioning system to orient the scale model of the missile containing model antennas, in the same relative position with respect to the pattern range equipment as the full-scale missile would have with respect to the ground station during flight. The antenna flight simulator also consists of a positioning tower and recording equipment. Author

N64-13651 Aerospace Corp., El Segundo, Calif. Engineering Div.
SATELLITE CONTROL FACILITY ACQUISITION AND LOST VEHICLE RECOVERY ANALYSIS STUDY
W. A. Sandberg 15 Sep. 1963 26 p
(Contract AF 04(695)-269)
(SSD-TDR-63-237; TDR-269(4110-01)-7; AD-425959)

The capabilities and limitations of the wide beam VHF antennas, when used as lost vehicle acquisition aids, have been assessed in this study; their relative abilities have also been compared. The study shows that the RF beamwidth and servodrive characteristics are adequate, but the controls are not suited for long duration, wide-angle searches. Antenna gain limits the usable range of the trihelix and quadhelix antennas for lost vehicle acquisition. Author

N64-13677 Joint Publications Research Service, Washington, D.C.
NEW SOVIET TELESCOPE – THE LARGEST IN EUROPE
B. K. Ioannisiani, A. B. Severnyy, and P. I. Shelovitelev *In its* New Methods in Astronomy 10 Jan. 1964 p 5–10 Previously Published in Pravda (Moscow), 20 Feb. 1961 (See N64-13676 05-01) OTS: $3.00

A brief description is presented of the development, construction, and capabilities of a new 2.6-m telescope. P.V.E.

N64-13690 Joint Publications Research Service, Washington, D.C.
EXPERIENCE GAINED IN USING A VACUUM CHAMBER FOR TESTING THE PRECISE MIRRORS OF ASTRONOMICAL INSTRUMENTS
V. A. Savin *In its* New Methods in Astronomy 10 Jan. 1964 p 148–152 (See N64-13676 05-01) OTS: $3.00

The testing of flat mirrors in a vacuum chamber is discussed, and it is concluded that this testing can be conducted with a marginal reliability and single-valuedness because of the lack of heterogeneous airflows and the lack of heat transfer to the mirror through convection currents and radiation. P.V.E.

N64-13818 General Electric Co., Cincinnati, Ohio Flight Propulsion Lab. Dept.
RESULTS OF WIND TUNNEL TESTS OF A FULL-SCALE, WING-MOUNTED, TIP-TURBINE-DRIVEN LIFT FAN
Ft. Eustis, Va., Army Transportation Res. Command, Sep 1963 305 p refs
(Contract DA-44-177-TC-584)
(TRECOM-TR-63-21; AD-426785)

Results of full-scale fan-in-wing model testing conducted in a 40 × 80 ft wind tunnel are presented. The series of tests provide large-scale test data on fans installed in wings. Analyses of the results are presented defining basic aircraft, fan internal system, and fan mechanical performance in the wind tunnel. In addition, the static fan and system performance was analyzed as a function of ground proximity. R.T.K.

N64-13877 Advisory Group for Aeronautical Research and Development, Paris (France)
A METHOD OF EVALUATING RUNWAY FRICTION FOR THE PREDICTION OF ACTUAL TAKE-OFF RUNS
G. Ciampolini (Fiat) Jan. 1963 16 p FRENCH Summary
(AGARD-418)

A method is described for obtaining practical values of the rolling coefficient of friction immediately before takeoff. Preliminary calculations can be made, using simple nomograms, of the actual ground-run distances for the atmospheric and ground conditions prevailing at the time. Author

N64-13883 Advisory Group for Aeronatutical Research and Development, Paris (France)
INVESTIGATIONS ON THE GROUND PERFORMANCE OF AIRCRAFT RELATING TO WET RUNWAY BRAKING AND SLUSH DRAG
Upshur T. Joyner, Walter B. Horne, and Trafford J. W. Leland (NASA. Langley Res. Center) Jan. 1963 39p refs
(AGARD-429)

A review is made of recent research in the United States relating to the ground performance of aircraft. Since many of the investigations have been conducted at the NASA Landing Loads Track at the Langley Research Center, a brief description of the track and its capabilities is given. Various factors affecting landing and takeoff distances are discussed, such as the runway surface conditions (whether dry, wet, or covered with slush) and the tire tread pattern and its state of wear. Performance calculations are presented for a typical jet transport showing the effect of runway slush on the takeoff distance; also shown are the effects of tire-to-runway braking coefficients on landing runout distances. Author

N64-13884 Advisory Group for Aeronautical Research and Development, Paris (France)
SIMULATOR ASSESSMENTS OF TAKE-OFF AND LANDING
A. G. Barnes (English Elec. Aviation) Jan. 1963 25p
(AGARD-432)

The value of flight simulators in assessing the take-off and landing characteristics of aircraft in the design stage is discussed. Problems associated with such simulation fall into two classes—computation and presentation. Possible solutions to some of these problems are presented, based on experience in a fixed-base simulator. Author

N64-13906 Holmes and Narver, Inc., Berkeley, Calif.
A STUDY OF TEST REACTOR OPERATING AND SAFETY EXPERIENCE, VOLUMES 1 AND 2
B. J. Garrick, W. J. Costley, and W. C. Gekler Washington, AEC Div. of Tech. Inform., 10 May 1963 422 p refs
(Contract AT(04-3)-424)
(HN-172(Vols. 1 and 2)) OTS: $5.00

This study was undertaken in order to cast existing test reactor operating experience in a form suitable for obtaining a better understanding of reactor safety. Test reactors were chosen as the focal point for an analysis of operating experience. The specific reactors chosen for study were those which had passed the initial shakedown period and, therefore, would provide meaningful operating experience. These include: three AEC reactors—Engineering Test Reactor (ETR), Material Testing Reactor (MTR), and Oak Ridge Research Reactor (ORR); and two privately owned reactors operated under license—General Electric Test Reactor (GETR) and Westinghouse Testing Reactor (WTR). The study covers both administrative and technical experience. The principal administrative subjects encompassed relate to the management and method of operation. The technical information is presented in the form of actually observed experience of reactor and experiment systems, including the kinds and origins of unscheduled power reductions. R.T.K.

N64-13918* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
JPL ADVANCED SOLAR SIMULATOR DESIGN TYPE A
R. M. Barnett and Carl Thiele 23 Apr. 1963 18 p
(NASA Contract NAS7-100)
(NASA CR-55206; JPL-TM-33-141) OTS: $1.60 ph, $0.80 mf

The solar simulator described is an integrated system in which each light source illuminates the entire test volume. Flexibility is obtained for mixing light sources to improve the spectral properties and for varying the size intensity and collimation characteristics as required for a particular purpose. In addition, the problems of shadow filling in on-axis Cassegrainian systems or beam-matching between modules are avoided. Since each light source fills the entire beam, time variations in intensity and spectrum can be monitored at a single point whereas time variations in uniformity are unlikely. The mixer can accept highly nonuniform light and produce uniform illumination efficiently. An analysis of the mixer and headlamp subsystems is included. R.T.K.

N64-13950 National Academy of Sciences-National Research Council, Washington, D.C. Materials Advisory Board
PROCESSING OF METALS IN INFAB
[1963] 20 p refs
(MAB-99-LM)

An attempt was made to indicate the utility of Infab by a careful assessment of an essential characteristic—the degree to which metals become contaminated. While it was found that suitable data are very meager, the existing evidence is sufficient to conclude that the facility does not totally preclude surface contamination. To provide a basis for judgment as to the alloys and operations for which Infab is advantageous, a small program to measure the kinetics of contamination during operation is recommended. The details of such a program are discussed. Author

N64-13975 Stanford U., Calif.
THE STANFORD AERONAUTICS AND ASTRONAUTICS DEPARTMENT HYPERSONIC WIND TUNNEL FOR STRUCTURAL RESEARCH
W. H. Horton and R. W. Johnson Aug. 1963 45 p refs
(Contract Nonr-225(30))
(SUDAER-164; AD-426043)

A hypersonic wind tunnel for experimental research in the area of reentry heating is described in detail, and its performance and research capability are discussed. The overall system is outlined followed by discussions of the high pressure air compressor and storage system, the regenerative gas fired heat exchanger, auxiliary services, the nozzle, the test section and model instrumentation, the optical system, tunnel performance, and the automatic safety system. C.L.W.

N64-13977 Stanford U., Calif.
A PRESSURE CONTROL SYSTEM FOR A HYPERSONIC WIND TUNNEL Technical Report 9
W. H. Horton and I. L. Smith Aug. 1963 28 p refs
(Contract Nonr-225(30))
(SUDAER-168; AD-426078)

The basic function of the analog controller is to position control the main air inlet valve and thus control the air pressure

in the pebble bed. It is possible to restrict the initial differential and to limit the degree of overshoot by adjustment of the gain controls in the main feedback loops. The length of run time is adjusted by a time delay relay. The completion of various steps, before the blow-down cycle can be instigated, causes a master control switch in the blow-down control system to close, and it is then possible to operate the blow-down cycle using the autocontroller. To do this, the desired operating pressure is set and the set point adjuster trimmed for the conditions of operation. The length of run is set on the variable thermal relay. The blown-down sequence is started by closing a single switch. The analog controller compares the existing pressure in the 2-inch line with the desired or set point pressure. The servoamplifier and valve convert the error voltage to the appropriate valve opening. Stability is achieved by rate term. I.v.L.

N64-13996 Lincoln Lab., Mass. Inst. of Tech., Lexington
IMPROVEMENT OF THE MEASUREMENT CAPABILITY OF THE UHF RADAR AT WALLOPS ISLAND
J. Freedman, ed. 10 Apr. 1963 63 p refs
(Contract AF 19(628)-500; ARPA Order 13; Proj. Defender)
(Tech. Rept. 305)

A modification program was undertaken to improve the range resolution of the UHF radar at Wallops Island from 1000 to 200 ft, and to extend the ability to measure unambiguous Doppler velocity from 400 to 1200 fps. The ability to measure details of wake characteristics has been improved by these modifications beyond that possible with other radar reentry measurement systems now in operation. Author

N64-14047 College of Aeronautics, Cranfield (Gt. Brit.)
A LOW-CONSTRAINT, HIGH-PRESSURE AIR FEED SYSTEM FOR WIND TUNNEL BALANCES
A. J. Alexander and W. G. Holloway Oct. 1963 10 p refs
(CoA-N-Aero-157)

A high-pressure air feed system, suitable for use with blowing models mounted on a six-component virtual-center balance, is described. Air is supplied to the balance by a flexible-ringmain feed so that no air is lost as with an air-bearing system. Constraints on the balance are very low; at an internal pressure of 30-psi gage with a mass flow of 0.5 lb/sec, all force corrections were less than 1 lb, and the pitching moment correction less than 0.5 lb-ft. Rolling and yawing moment corrections were 2.0 lb-ft and 2.7 lb-ft, respectively. The constraints were measured using a calibrator which enabled the desired mass flow to be passed through the system without additional constraints. Author

N64-14089 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
CALIBRATION OF THE HYPERVELOCITY IMPULSE TUNNEL
J. A. Copper and F. J. Hameetman Oct. 1963 48 p refs (SM-43060; AD-426699)

This shock tunnel uses the tailored-interface and equilibrium-interface techniques to provide test durations of at least 10 msec. These test durations are sufficiently long to enable forces and pressures as well as heat-transfer rates to be measured. Results of the calibration of the test section of the HIT are presented. Flow uniformity and repeatability, inviscid core size, the effects of reservoir pressure, reservoir enthalpy level, and test-section axial location are discussed. Velocities up to 17,000 fps, test section Mach numbers between 8.1 and 22.6, and Reynolds numbers between 2.5×10^3 and 4×10^6 per foot have been observed. Pressure and heat-tranfer distributions on simple bodies have been measured at nominal Mach numbers of 9 and 23, respectively. These investigations are interpreted according to appropriate aerothermodynamic theory and are compared with data from other facilities. Author

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-13601 Avco Corp., Wilmington, Mass. Research and Advanced Develop. Div.
NONEQUILIBRIUM, NONSIMILAR SOLUTIONS OF THE LAMINAR BOUNDARY LAYER EQUATIONS
A. J. Pallone, J. A. Moore, and J. I. Erdos 19 Nov. 1963 65 p refs
(Contract AF 04(694)-239)
(RAD-TM-63-58; AD-424499)

A method of solution of the laminar boundary-layer equations for dissociating and ionizing air in chemical nonequilibrium is formulated for arbitrary pressure gradients and body geometry. A nonsimilar, multistrip integral technique is employed in conjunction with previously derived transport and thermodynamic properties for the multicomponent mixture. Several numerical examples are carried out for a sharp conical bodies (assuming a fully catalytic cold wall) at reentry velocities and altitudes between 115 and 200 kilofeet. The results are used to demonstrate a number of salient features of the flow fields; among these are the dominant role of diffusion in counterbalancing the production of dissociated and ionized species, the relative importance of accurate transport properties in the momentum and energy equations (as reflected in the species production), and the persistence of chemical nonequilibrium to relatively low altitudes (below 15 kilofeet) for slender, sharp vehicles at reentry velocities. Author

N64-13610 Aerospace Corp., San Bernardino, Calif.
DISCONTINUITY OF SURFACE CATALYCITY IN SHOCK TUBE FLOWS
Paul M. Chung and S. W. Liu Oct. 1963 39 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-285; TDR-269(S4230-20)-1; AD-424915)

Surface recombination of atoms on a perfectly catalytic surface element located downstream of a noncatalytic surface is analyzed behind a strong moving shock. The unsteady diffusion boundary layer is considered to be chemically frozen. The solution is obtained in a form of perturbations to the instantaneous steady-state solution. The region in which the rate of surface reaction can be computed with a sufficient accuracy by use of the instantaneous steady-state solution is determined. The application of the theory to the operation of differential catalytic gages located either on the shock tube wall or on a flat plate inserted into shock tube is discussed. It is shown that the sensitivity of the gages can be increased by 50% to 80% readily by utilizing the catalytic surface of the gages located downstream of a noncatalytic surface. Author

N64-13617 Southwest Research Inst., San Antonio, Tex.
HYDRODYNAMICS OF SHIP SLAMMING Final Report [1 Nov. 1958-30 Sep. 1963]
H. Norman Abramson and J. F. Dalzell 30 Sep. 1963 18 p refs
(Contract Nonr-2729(00))

This report presents a review of work accomplished by means of summaries of published papers and technical reports, and contains further discussion of the problem, and some recommendations for future research. Author

N64-13642 Naval Weapons Lab., Dahlgren, Va.
SYMMETRIC STAGNATION AND WAKE FLOWS PAST A SEMI-INFINITE PLATE
Ernst W. Schwiderski and Hans J. Lugt Sep. 1963 61 p refs
(NWL 1886; AD-426676)

The class of all solutions of the Navier–Stokes equations, which represent symmetric motions past a semi-infinite flat plate, is constructed in the form of a double series around the edge of the plate. In contrast to the classical boundary-layer equations, the Navier–Stokes equations emerge as a proper means to describe laminar flows past leading and trailing edges in a realistic manner. Flow patterns of laminar attached or separated motions around leading and trailing edges can be derived up to very refined details from the solutions obtained. Also, the analogous needle problem is discussed briefly.
Author

N64-13649 Naval Ordnance Test Station, China Lake, Calif.
SWIMMING HINGED HYDROFOILS
Howard R. Kelly and Glenn H. Bowlus Dec. 1963 68 p refs
(NOTS-TP-3342; NAVWEPS-8411; AD-426536)

Lift, drag, and power input were measured on three configurations of a small, symmetrical hydrofoil that was mechanically oscillated in a two-dimensional waterflow. The tests included oscillations of different amplitudes in combined heaving and pitching of the rigid, single-hinged, and double-hinged hydrofoils, and simple oscillations (waving) of the hinged hydrofoils with one point fixed. The drag coefficients (positive and negative) are compared with Wu's theory of swimming hydrofoils. The Wu theory can successfully predict the thrust of an oscillating hydrofoil, whether it is rigid or hinged.
Author

N64-13753 Wisconsin U., Madison Mathematics Research Center
ON THE STABILITY OF SPIRAL FLOW BETWEEN ROTATING CYLINDERS
E. R. Krueger and R. C. Di Prima Oct. 1963 35 p refs
(Contract DA-11-022-ORD-2059)
(MRC-430; AD-426494)

Stability of a viscous fluid between two concentric rotating cylinders with an axial flow is investigated. Two methods are employed to solve this problem when both cylinders are rotating in the same direction and when the gap between the cylinders is small. Results are given for small amounts of axial flow that indicate that the critical Taylor number increases with increasing amounts of axial flow. The results are compared with previous experimental and theoretical results. The problem when both cylinders are rotating in opposite directions is studied in the small gap case, and results are obtained for small amounts of axial flow that indicate that the Taylor number increases with increasing amounts of axial flow.
Author

N64-13758 Stanford U., Calif. Thermosciences Div.
AN EXPERIMENTAL INVESTIGATION OF THE FLOW STRUCTURE OF THE TURBULENT BOUNDARY LAYER
P. W. Runstadler, S. J. Kline and W. C. Reynolds Jun. 1963 324 p refs
(Grant AF-AFOSR-136-63)
(MD-8; AFOSR-TN-5241; AD-421683)

A distinct structure picture was found for each of the known zones of the mean velocity profile, and the structure was found to change gradually from one picture to another at each point where a change in mean profile occurred. Results demonstrate the relation between the eddy structure and the mean profile, particularly for the flat-plate case. A detailed verification and correlation of spacing of the "streaks" found in the inner or wall layers of the flow are presented. The following was also demonstrated: the flow model of the wall layer consists of alternating "streaks" of high- and low-speed fluid; these streaks move in time and are random over space for long time periods; the streaks "break up" and the eddies so created follow certain distributions of trajectories in the outer flow. The correlation for streak spacing was well established for the flat-plate case. The correlations for break-up frequency and trajectories were less accurate, but quantitative measurements are given. An interpretation of the implications of the observed flow models is also included. R.T.K.

N64-13837 Aro, Inc., Arnold Air Force Station, Tenn.
CHARACTERISTICS OF AXISYMMETRIC AND TWO-DIMENSIONAL ISOENERGETIC JET MIXING ZONES
R. C. Bauer Arnold Eng. Develop. Center, Dec. 1963 114 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-63-253; AD-426116)

Tables of mass-flow and momentum integrals are presented for 28 Crocco numbers in the range 0 to 1.0. This is an expansion of the work done by Korst, which covers the Crocco number range from 0 to 0.916. It is shown theoretically that an axisymmetric mixing zone can be treated as a two-dimensional mixing zone if the projected thickness of the mixing zone on the radius of symmetry is less than 0.30 of the radius symmetry. Applying the results of this analysis to Korst's supersonic base-pressure theory shows that axisymmetric effects on mixing tend to increase base pressure relative to the two-dimensional value.
Author

N64-13889 Army Missile Command, Huntsville, Ala.
GENERALIZED DEPENDENCIES FOR HEAT EMISSION DURING BLISTERED BOILING OF LIQUIDS
D. A. Labuntzov 22 Nov. 1963 19 p refs Transl. into ENGLISH from Teploenerg. (Moscow), v. 7, no. 5, 1960 p 76–81
(RSIC-101; AD-425717)

A new generalized dependence is proposed for heat emission during blistered boiling of liquids for which $Pr > 0.86$, and a comparison is made of the existing equations and the new generalized dependence with the test data on heat emission. It is found that the generalized dependence describes the experimental material in a better manner. In addition, an investigation of conditions leading to the formation of vapor blisters on the heating surface and their rate of further growth shows that the high intensity of the heat exchange should basically be determined by the intense pulsations of the liquid particles directly on the heating surface itself. I.v.L.

N64-13922 Chile U., Santiago Lab. de Hidraulica
INTERNATIONAL SEMINAR ON HYDRAULICS AND MECHANICS OF FLUIDS, 20 TO 25 OF AUGUST, 1962, SANTIAGO DE CHILE. GENERAL BULLETIN [SEMINARIO INTERNACIONAL DE HIDRAULICA Y MECANICA DE FLUIDOS, 20 AL 25 DE AGOSTO, 1962, SANTIAGO DE CHILE INFORME GENERAL]
1963 243 p refs in SPANISH; ENGLISH and FRENCH summaries

The topics discussed include: local scour around piers in rivers; water depth over a drop; critical tractive velocity in alluvial channels; application of the Colebrook formula to open channel flow; variation with time of pipe capacity; application of the momentum theorem to unsteady flow; water level behind a free overfall nappe on an inclined bottom; hydraulic performance of an automatic gate operated by water level; added mass and flow net; a direct method of pipeline computation—application to pump selection, hydraulic study of the canal, pressure tunnel and surge tank system, image system within an ellipse due to an external source, an approximation for the motion of a compressible liquid, the momentum equation when there is a change in the velocity direction, distribution of velocities in rivers of central Chile, pitot tube calibrations, and sedimentation at Rapel Reservoir. R.T.K.

N64-13956 Harry Diamond Labs., Washington, D.C.
FLUID AMPLIFICATION. 6. AERODYNAMIC STUDIES OF FREE AND ATTACHED JETS
Robert E. Olson and David P. Miller 14 Oct. 1963 207 p refs
(Contract DA-49-186-ORD-912)
(A-1771-24; supersedes A-1771-16; AD-427335)

Theoretical and experimental investigations were conducted to provide information regarding the aerodynamic characteristics of two-dimensional turbulent compressible jets. The investigations included studies of free jets, wall jets, and reattaching jets. The theoretical investigations provided analytical models for the three types of jet flows, procedures for predicting the velocity profile development characteristics for free jets and wall jets, and a procedure for predicting the reattachment location and mean pressure in the separation bubble for reattaching jets. The experimental studies which were conducted provided data to substantiate the analyses and to evaluate empirical constants. These data included measurements of the flow profiles at various stations downstream of the nozzle exit for the three types of jet flows. Author

N64-13999 Army Materials Research Agency, Watertown, Mass. General Thomas J. Rodman Lab.
NUMERICAL STUDIES OF POINT PERTURBATIONS IN LAMINAR PLANE POISEUILLE MOTION
Eugene De Luca (M.S. Thesis—MIT, 1962) Aug. 1963 45 p refs
(AMRA-TR-63-10; AD-423640)

A finite-difference technique is developed to study the time-dependent two-dimensional isothermal flow of an incompressible, Newtonian fluid between infinite, parallel planes. A theoretical analysis of the convergence and stability of the difference scheme is presented. The method developed is used to determine the propagation of a disturbance in the flow regime by numerical integration (with respect to time and space) of the nonlinear equations of motion for the perturbed-plane Poiseuille flow. Several test computations are carried out wherein a small, point, vorticity perturbation is introduced into an initially laminar flow field; the perturbation is introduced on the channel axis. Vorticity distributions in the neighborhood of the channel axis, following perturbation, are presented in graphical form; the effects of perturbation magnitude and Reynolds number on vorticity propagation are discussed in a qualitative manner for the cases studied. Author

N64-14003 California U., Berkeley Inst. of Engineering Research
ON THE STABILITY OF VISCOUS FLOW BETWEEN ROTATING CYLINDERS; FINITE GAP II
Lionel Rintel and Paul Lieber Dec. 1963 14 p refs
(Contract Nonr-222(87))
(MD-63-2; AD-426412)

Results previously reported under the same title are modified to give an approximate representation of the stability conditions without restricting the gap size. It is thus found that results based on the proposed principle of averaging are in good agreement with results obtained by much more elaborate calculations. This agreement justifies the extrapolation of the results obtained for the case of infinite gap. Author

N64-14032 Massachusetts Inst. of Tech., Cambridge Engineering Projects Lab.
AN INDEX TO THE TWO-PHASE GAS-LIQUID FLOW LITERATURE, PART I
S. William Gouse, Jr. May 1963 320 p refs
(Contract Nonr-1841(73))
(DSR-8734-1; AD-411512)

A total of 2000 separate references on certain types of two-phase gas-liquid flow phenomena have been found, verified, listed, and indexed by subject and principal author. This literature survey was carried out as one phase of a program to determine the state-of-the-art in two-phase gas-liquid flow phenomena. The problem areas of condensation, cavitation, and atomization have been excluded except when references were of such a basic character as to be generally useful. Author

N64-14051 College of Aeronautics, Cranfield (Gt. Brit.)
AN INVESTIGATION OF VORTEX BREAKDOWN AT MACH 2
A. H. Craven and A. J. Alexander Nov. 1963 17 p refs
(CoA-N-Aero-158)

Wind-tunnel tests have been made at M = 2 on a 75° swept delta wing in order to study the progressive breakdown of the leading edge vortices that occurs at high incidence. The incidence at which vortex breakdown occurred at supersonic speeds was somewhat less than at low speeds, but the pattern of breakdown appeared to be similar, although the spiraling region of flow is much larger at supersonic speeds. Quite slender objects placed downstream of the wing had appreciable upstream effects, causing vortex breakdown to move upstream by as much as 20% of the root chord for the same incidence. Author

N64-14066 General Dynamics/Astronautics, San Diego, Calif.
CATALYSIS OF NOZZLE FLOWS
H. Girouard [1964] 11 p refs Presented at the AIAA Aerospace Sci. Meeting, N.Y., 20–22 Jan. 1964
(AIAA Paper 64-98) AIAA: $0.50 members, $1.00 nonmembers

Two methods of attaining high propellant performance are described—chemical catalysis and optimum nozzle contours.

A theory for and experimental data on the catalysis of hydrogen atom recombination are presented. The evidence is described to show that small mounts of catalyst can increase the rates of highly exothermic combination reactions by orders of magnitude. The theory is extended to show the nature of catalysis in more complex propellants. The catalysis of hydrogen atom recombination for nuclear rockets is evaluated in connection with an original approach toward obtaining optimized nozzle geometries for chemically reacting propellants. The results indicate that the propellant specific impulse could be substantially improved using a chemically reacting propellant concept. Author

N64-14067 National Aeronautical Establishment, Ottawa (Canada)
A WATER TUNNEL INVESTIGATION OF THE FLOW SEPARATION ABOUT CIRCULAR CONES AT INCIDENCE
W. J. Rainbird, R. S. Crabbe and L. S. Jurewicz Ottawa, Natl. Res. Labs., Sep. 1963 58 p refs
(LR-385; NRC-7633)

Flow visualization measurements, using fluorescent dye filaments, have been made on two right circular cones of semi-apex angles 7 1/2°, and 12 1/2°, at incidences up to about 40°, in a 10- × 13-in. water tunnel. All tests were performed at a length Reynolds number of about 2.7×10^4, thus ensuring that the flow within boundary layers, separated vortex sheets, and vortex cores was laminar. Details of the flow at small, moderate, and large incidence (relative to semi-apex angle) have been elucidated, and comparisons have been made with some previously unpublished wind tunnel experiments. The angular positions of all separation and attachment lines, and the directions of the "surface" steamlines between such lines have been measured. Comparison of these quantities with the results of three-dimensional laminar-boundary-layer momentum integral calculations, using Cooke's method, shows good agreement, particularly at small relative incidence. Author

N64-14107 Republic Aviation Corp., Farmingdale, N.Y.
RESEARCH INVESTIGATION OF HYDRAULIC PULSATION CONCEPTS Third Quarterly Progress Report [1 Sep. - 30 Nov. 1963]
30 Nov. 1963 51 p
(Contract AF 33(657)-10622)
(RAC-933-3; AD-425917)

Designs of a piston-type transformer, fluid-level control unit, and rectifier valve were studied. Analyses of transmission lines considered as distributed parameters, together with other transmission line effects and parameters, were made. Overall efficiency of the miniaturized pulsating system received preliminary study. Materials for use with liquid-metal fluids were also studied. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-13471 Argentina. Comision Nacional de Energia Atomica, Buenos Aires
PROCESSING LITHIUM MINERALS IN SAN LUIS AND CORDOBA PROVINCES [YACIMIENTOS DE MINERALES DE LITIONDE LAS PROVINCIAS DE SAN LUIS Y CORDOBA]
V. Angelelli and C. A. Rinaldi 1963 79 p refs In SPANISH (*Its* Informe 91)

The minerals containing lithium which are of economic importance and which are found in San Luis and Cordoba are given as spodumene, lepidolite, petalite, and amblygonite. It has been found that 3.5% lithium oxide is obtained from lepidolite and petalite and 5% Li_2O is obtained from spodumene, whereas 7% is obtained from amblygonite. The general method for processing the minerals and the lithium compounds obtained from them is described, and the economic uses of lithium and its compounds are given. Trans. by D.E.R.

N64-13597 Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
EVALUATION OF A VARACTOR DIODE PARAMETRIC AMPLIFIER FOR RAWIN SET AN/GMD-2
Konstantins Pocs Sep. 1963 26 p refs
(Contract AF 19(628)63-1338)
(*Its* Instrumentation for Geophys. and Astrophys. No. 29; AFCRL-63-761; AD-423824)

The exceptionally low noise characteristics of this amplifier are related to the benefits derived by the Rawin Set for increased tracking range and signal-to-noise improvement. It makes possible the use of a lower power transmitter in the radiosonde, and will decrease the volume, weight, and power consumption of the airborne equipment. In 3 months of operation, the parametric amplifier has maintained a 2-db noise figure, with less than 0.5 db shift in gain. Author

N64-13623 Texas Instruments, Inc., Dallas, Tex.
TERRAIN QUANTIFICATION. PHASE II: PLAYA AND MISCELLANEOUS STUDIES Final Report
Donald D. Carr, Ronald E. Becker and Jack R. Van Lopik 6 Oct. 1963 102 p refs
(Contract AF 19(628)-2786)
(AFCRL-63-793; AD-426544)

Field investigations were undertaken to test militarily significant techniques for mapping terrain factors in a desert environment characterized by playas and related landforms. This was supplemented by office studies concerned with: (1) state-of-the-art methods for measurement and classification of microrelief, (2) extrapolation of surface geometry parameters from smaller to larger map scales, and (3) landform analysis by application of microdensitometer measurements on aerial photographs. Conclusions, though tentative in nature, point up the lack of any suitable technique or system for microrelief classification and indicate that areal slope distributions determined from contour maps are not satisfactory as index properties of surface geometry. The conceptual basis for a new terrain sampling method is discussed. Author

N64-13652 Northeastern U., Boston, Mass.
ON THE POSSIBILITY OF PRODUCING ARTIFICIAL AURORAS Scientific Report No. 4
Giovanni Lanza 28 Jun. 1963 18 p refs
(Contracts AF 19(604)-7358 and AF 19(604)-8462)
(AFCRL-63-641; AD-425787)

The theoretical possibility of artificially producing an aurora in a weakly ionized gas, exposed to the action of an alternating electric field of proper frequency and of a constant magnetic field, was investigated. In order to discuss the excitation of

optical levels and the emission of light, it was necessary to determine the velocity distribution function of the electrons of the plasma exposed to the action of the electric and magnetic field. The distribution function was determined as a function of the electric-field intensity and its frequency, the magnetic field, and the plasma parameters. It was demonstrated that the electrons of a weakly ionized plasma, under the action of an alternating field, could be accelerated up to an energy of several ev. These accelerated electrons colliding with the neutral molecules of the plasma can induce excitation and eventually ionization. The procedure which permits the exploration of the various processes of emission of light is outlined. R.T.K.

N64-13658 NRA, Inc., Long Island City, N.Y.
METHODS OF PROMOTING THE REMOVAL OF FREE ELECTRONS FROM AN IONIZED AND DISSOCIATED ATMOSPHERE
W. Arthur and A. Beiser Jun. 1963 25 p refs
(Contract AF 19(628)-255; DASA MIPR 554-61)
(NRA-113-4004; AFCRL-63-380; AD-426145)

This study included an analysis of the relevant atomic and ionic processes (with special regard to the dependence of these processes upon electrical energy) and quantitative assessment of the various possible means for removal of free electrons from such an atmosphere, including estimates of time scales, efficiencies, and power requirements. Author

N64-13660 St. Louis U., Mo.
THE DIRECTION OF MOTION AT EARTHQUAKE FOCI Final Report
William Stauder 31 Jul. 1963 7 p refs
(Contract AF 19(604)-8054; ARPA Order 180-61; Proj. Vela-Uniform)
(AFCRL-63-797; AD-426263)

The use of S-wave data is shown to provide important information on the mechanism of earthquake foci and to permit a determination of the focal mechanism in cases where P-wave data alone do not suffice. Regional compressive stresses are examined, and the occurrence of earthquakes registering compressions at all azimuths is studied. The S-wave techniques have been adapted to a least-squares procedure for computer analysis of the data. Author

N64-13836 Rhode Island U., Kingston
THE THEORY OF SURFACE WAVE DIFFRACTION BY SYMMETRIC CRUSTAL DISCONTINUITIES Scientific Report No. 4
Julius Kane and John Spence Bedford, Mass., Af Cambridge Research Labs., Nov. 1963 34 p refs
(Contract AF 19(628)-319; ARPA Order 180-62; ARPA Order 292-62; Proj. Vela-Uniform)
(AFCRL-63-719; AD-427136)

By use of symmetry considerations and variational techniques, reflection, transmission, and conversion coefficients are obtained for elastic wave diffraction at symmetric wedge-shaped obstacles for both Rayleigh and Love wave excitation. Author

N64-13861 Emmanuel Coll., Boston, Mass.
CERTAIN FEATURES OF TURBULENT EXCHANGE IN THE GROUND LAYER DURING WINTER IN PEKING
Chao Ber-lin Bedford, Mass., AFCRL, Jun. 1956 17 p refs
Transl. into ENGLISH from Peking U.J., Nat. Sci., Vol. 2(4), 1956 p 479–488
(Contract AF 19(604)-8505)
(E-T-Ch-63-7; AD-420360)

This paper deals primarily with a computation of certain features of the turbulent exchange of the ground layer, e.g., the austausch coefficient and heat flux transfer, during winter in Peking. Results obtained by various mathematical procedures are compared and discussed. Comments on Budyko's formula are made in the appendix. Author

N64-13905 National Bureau of Standards, Boulder, Colo.
AN ATLAS OF WHISTLERS AND VLF EMISSIONS. A SURVEY OF VLF SPECTRA FROM BOULDER, COLORADO
D. L. Jones, R. M. Gallet, J. M. Watts, and D. N. Frazer Jan. 1963 100 p refs
(NBS-TN-166; PB-181454) OTS: $2.25

Naturally occurring VLF noises are classified, and spectrograms illustrating each class are presented. The report is divided into six sections. The first section consists of the systematic classification of VLF noises. Samples of whistlers and VLF emissions are shown in the second and third sections, respectively. The next section gives examples of interactions between these two classes. Section five consists of some exceptionally active periods during magnetic disturbances. The last section is a synoptic survey for the four months, March through June 1957. A spectrogram is given for every observation period containing any VLF activity. Author

N64-13948 Joint Publications Research Service, Washington, D.C.
GEOPHYSICAL INVESTIGATION OF THE STRUCTURE OF THE EARTH'S CRUST IN THE TRANSITION ZONE FROM THE ANTARCTIC CONTINENT TO THE INDIAN OCEAN BETWEEN 55° AND 100° EAST LONGITUDE
V. A. Gladun et al 24 Jan. 1964 6 p refs Transl. into ENGLISH of a paper from Dokl. Akad. Nauk SSR (Moscow), v. 153, no. 12, 11 Nov. 1963 p 427–428
(JPRS-22888; OTS-64-21383) OTS: $0.50

The results of the geological and geomorphological investigations of the region indicate that, with regard to the nature of the variation in the thickness of the earth's crust and possibly to its structure, three sections may be defined: (1) to the east of longitude 80° E.; (2) between longitude 70° and 80° E.; and (3) west of longitude 70° E. Within the limits of the first section, the thickness of the earth's crust changes smoothly to 30 km, which is geomorphologically expressed in the presence of a relatively wide shelf zone (up to 250 km) and is then reduced sharply to 18 km in a zone with a width of 50 to 100 km. In the second section, in the vicinity of Prydz Bay, the thickness of the earth's crust is less than at the same latitude in the transition zone to the east or to the west of the bay. Within the limits of the third section, the zone of the smooth change in the thickness of the earth's crust, a geomorphological reflection that is usually found in the form of a shelf is almost entirely absent. P.V.E.

N64-14010 Stanford Research Inst., Menlo Park, Calif.
MEASUREMENT OF NITRIC OXIDE IN THE EARTH'S ATMOSPHERE Final Report
Robert A. Young 22 Jul. 1963 28 p refs
(Contract DA-49-146-XZ-112)
(DASA-1419; AD-426945)

The results of an investigation of a possible technique to measure the nitric oxide in the lower ionosphere and to develop realistic specifications for rocket-borne instrumentation are discussed. The technique developed is based on the controlled photoionization of nitric oxide by a local photoionization source, with subsequent collection and quantitative measurement of the resulting ions and electrons. P.V.E.

N64-14080 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
PLASMA RESONANCES IN THE UPPER IONOSPHERE
W. Calvert and G. B. Goe Repr. from J. Geophys. Res., v. 68, no. 22, 15 Nov. 1963 p 6113–6120 refs

Plasma resonances, detected in the upper atmosphere with the Alouette topside sounder satellite, have been examined. The resonant frequencies have been found to be f_N and $(f_N^2 + f_H^2)^{1/2}$, where f_N is the plasma frequency and f_H is the electron gyrofrequency. The two resonances are attributed to electron oscillations along and across the earth's magnetic field, respectively. Author

N64-14161 International Union of Geodesy and Geophysics (Japan)
REPORT OF THE GEODETIC WORKS IN JAPAN FOR THE PERIOD FROM JAN. 1960 TO DEC. 1962
1963 22 p refs Presented at the 13th Gen. Assembly, Berkeley, Calif., 19–31 Aug. 1963

This summary of geodetic works in Japan includes the following: (1) Triangulation—The astronomical azimuth observation was carried out with transit instruments until 1961. Since 1962, the azimuth has been determined by observing Polaris with theodolites. Moreover, the number of base lines has been approximately doubled. (2) Leveling—Precise leveling was revised for about 480 km in the southern part of Kyushu and for about 500 km in the northern part of Hokkaido. The vertical movements of the earth's surface in these districts were obtained. It has been shown that the earth's surface is sinking by about 20 cm/yr, at the most severe region, in industrial areas around Tokyo Bay, the Ise Bay, the Osaka Bay, and Niigata. (3) Geodetic Astronomy—Astronomical longitude, latitude, and azimuth were determined at the 17 primary stations in the first order triangulation network. Also, a practical method for determining the geodetic position of a station, based on satellite observation, has been developed. I.v.L.

N64-14162 Joint Publications Research Service, Washington, D.C.
NEW TRENDS IN THE DEVELOPMENT OF SUBMARINE RESEARCH
R. B. Mamayeva and V. G. Azhazha 31 Jan. 1964 5 p Transl. into ENGLISH of an article from Vestn. Akad. Nauk SSSR, (Moscow), no. 9, Sep. 1963 p 88–89
(JPRS-23001; OTS-64-21442) OTS: $0.50

New trends in the development of underwater research include: (1) the use of underwater photography for organizing the proper operation of submerged hydrotechnical structures; (2) the use of underwater studies to establish the inherent trends of the sediment formation in the sea-cliff regions, particularly the formation and distribution of ferromanganese concretions and to establish the ancient shore lines as is needed in paleographic reconstructions; (3) the use of aqualungs to investigate underwater volcanoes; (4) the development of a method of underwater stereophotogrammetry and the use of this method for gaining information on the ice cap; (5) the determination of the herring concentration with the aid of underwater photography and echo sounding; and (6) the use of underwater research in the study of caves. I.v.L.

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-13578 Joint Publications Research Service, Washington, D.C.
HEAT CONDITIONS IN RADIO AND ELECTRONIC PERFORATED APPARATUS
G. N. Dul'nev and E. M. Semyashkin *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 154–163 refs (See N64-13565 05-01) OTS: $3.00

Theoretical fundamentals of designing the heat conditions for perforated radio and electronic equipment with horizontally located chassis are analyzed. The manner of calculating the heat characteristics is described. Author

N64-13579 Joint Publications Research Service, Washington, D.C.
ACALORIMETERS WITH OPEN SURFACES
A. F. Begunkova *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 164–175 refs (See N64-13565 05-01) OTS: $3.00

The application of acalorimetric methods to determine the coefficient of heat conductance of materials requires the creation of an infinitely large value of the coefficient of heat transfer ($\alpha \to \infty$) over the entire surface of the specimen. In this article, an acalorimeter method is presented for which the condition $\alpha \to \infty$ must be fulfilled only for two facets of the specimen. Author

N64-13723 Hayes International Corp., Birmingham, Ala.
A STUDY OF THE RADIATIVE CHARACTERISTICS OF SHIELDED INFRARED SOURCES Interim Report
C. M. Askey et al Fort Eustis, Va., Army Transportation Res. Command Oct. 1963 111 p
(Contract DA-44-177-TC-805)
(TRECOM-TR-63-45; AD-426787; ER-649)

An account is given of an experimental measurements program and an empirical formulation for determining the radiative characteristics of shielded infrared sources. Included is a detailed description of the apparatus and instrumentation used in the experimental program and the computer programs for predicting radiant intensity as a function of aspect angle. The results of the empirical formulation when compared with the experimental measurements clearly indicate the feasibility of this method. Author

N64-13820 Naval Ordnance Lab., Corona, Calif.
IMPROVED BLACK RADIATION DETECTOR
R. L. Bates and W. L. Eisenman 15 Dec. 1963 14 p refs
(*Its* Photodetector Ser., 60th Rept. NOLC-594; AD-426778)

An improved black radiation detector, developed as a standard for evaluating infrared detectors, appears to have an effective absorptance of from 0.995μ to 45μ. Measurements of the

spectral characteristics of 3 radiation thermocouple detectors, 2 thermistor bolometers, and a Golay pneumatic detector are compared with that of the conical detector over the spectral range of 1μ to 40μ. Author

N64-13821 Wisconsin U., Madison
STEADY STATE THERMAL STRESSES IN AN ELASTIC SOLID BOUNDED BY TWO CONES
Subhendu K. Datta Sep. 1963 24 p refs
(Contract DA-11-022-ORD-2059)
(MRC-418; AD-426496)

A similarity transformation has been developed to study thermal stress in a solid body bounded by one or two cones. If the temperature on the free surfaces is prescribed as powers of distance from the vertex, a set of similarity variables can be found which reduce the thermoelastic equations into Legendre equations, and consequently, the problem can be solved easily. A solution is given in detail for the particular case when the bounding free surfaces are maintained at constant temperature. A figure shows the variations of normal and shear stresses along different radial lines inside the body. Author

N64-13936* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
CONVECTIVE HEAT TRANSFER IN A CONVERGENT-DIVERGENT NOZZLE
L. H. Back, P. F. Massier, and H. L. Gier 15 Nov. 1963 35 p refs
(NASA Contract NAS7-100)
(NASA CR-55317; JPL-TR-32-415) OTS: $3.60 ph, $1.24 mf

The investigation covered a range of stagnation pressures from 30 to 250 psia, stagnation temperatures from 1030° to 2000° R, and nozzle-inlet boundary-layer thicknesses between 5% and 25% of the inlet radius. Steady-state heat-transfer rates from air heated by the combustion of methanol were determined locally from measurements using thermocouples embedded in the nozzle wall. The most significant unexpected trend in the results is the reduction in the heat-transfer coefficient, below the variation with stagnation pressure anticipated for a turbulent boundary layer, at stagnation pressures less than about 75 psia. The results include a maximum in the heat-transfer coefficient upstream of the throat, where the mass flow rate per unit area is largest, and a substantial decrease of the heat-transfer coefficient downstream of the point of flow separation, which occurred in the divergent section of the nozzle at the low stagnation pressures. A reduction of about 10% in the heat-transfer coefficient resulted from an increase in the inlet boundary-layer thickness between the minimum and maximum thicknesses investigated. Author

N64-13971 National Bureau of Standards, Washington, D.C.
STANDARDIZATION OF THERMAL EMITTANCE MEASUREMENTS. PART IV: NORMAL SPECTRAL EMITTANCE, 800°-1400° K Technical Report, 1 Jul. 1958-31 Oct. 1962
William N. Harrison, Joseph C. Richmond, Frederick J. Shorten, and Horace M. Joseph Wright-Patterson AFB, Ohio. AF Materials Lab., Nov. 1963 97 p
(Contract AF 33(616)-61-02)
(WADC-TR-59-510, Pt. 4; AD-426842)

Equipment and procedures were developed to measure normal spectral emittance of specimens that can be heated by passing a current through them, at temperatures in the range of 800° to 1400° K, and over the wavelength range of 1μ to 15μ. A data-processing attachment for the normal spectral emittance equipment was designed to: (1) automatically correct the measured emittance for 100%-line and zero-line errors on the basis of previously recorded calibration tests; (2) record the corrected spectral emittance values and wavelengths at preselected wavelength intervals on punched paper tape in form suitable for direct entry into an electronic digital computer; and (3) compute during a spectral emittance test on a specimen the total normal emittance, or absorptance for radiant energy of any known spectral distribution of flux, of the specimen. Author

N64-13982 AeroChem Research Lab., Inc., Princeton, N.J.
ANALYSIS OF AIR ARC-TUNNEL HEAT TRANSFER DATA
Daniel E. Rosner 2 Jan. 1964 10 p refs
(Contract AF 49(638)-1138)
(TP-76; AD-426382)

A direct procedure for estimating catalytic activities from calorimeter heat-transfer data is given, and a prediction is made of the stagnation pressure levels at which gas-phase atom recombination should mask the observed effects of calorimeter surface specificity under arc-tunnel conditions. Factors governing the probability of atom recombination on metal and odide surfaces are briefly discussed in the light of recent kinetic observations. E.W.

N64-14038 Little (Arthur D.) Inc., Cambridge, Mass.
STUDY OF HIGH TEMPERATURE THERMODYNAMICS OF LIGHT METAL COMPOUNDS Progress Report No. 7, 1 Jul.-30 Sep. 1963
Alfred Büchler [30 Sep. 1963] 15 p
(Contract DA-19-020-ORD-5584; ARPA Order 40-62)
(C-64362; AD-425826)

High-temperature thermodynamics of light metal compounds is reviewed. Further work on the lithium-beryllium fluoride system has confirmed the fragmentation pattern of the dimer deduced from earlier mass-spectrometric experiments. Electrochemical emf measurements have shown that the activity coefficient of beryllium fluoride in solution saturated with LiF is of the order of 0.1, which is in agreement with mass-spectrometric estimates. Electric deflection experiments were conducted on AlF, B_2O_3, BaF_2, CaF_2, ZnF_2, and $HgCl_2$. These experiments were carried out with a modified quadrupole refocusing system. Results of these experiments lend support to the conclusion that the refocusing in the alkaline earth halides does indeed indicate a nonlinear structure. Also, data are presented on: (1) mass-spectrometric heats of sublimation for LiF, its dimer, and trimer; (2) heats of sublimation of gaseous LiF, its dimer, and trimer; and (3) heats of dimerization and trimerization of lithium fluoride. I.v.L.

N64-14058 Oak Ridge National Lab., Tenn.
THE EXPERIMENTAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF MOLTEN LITHIUM FROM 600 TO 1550 DEGREES FAHRENHEIT
J. W. Cooke (M.S. Thesis-Tenn. U.) 23 Jan. 1964 163 p refs
(Contract W-7405-eng-26)
(ORNL-3390) OTS: $2.75

A comparative, axial-heat-flow apparatus with compensating guard heating was successfully designed, constructed, and operated to determine the thermal conductivity of a molten sample of 99.82 weight percent lithium metal. The results can be represented within ±2.2%-rms deviations by the linear least-square line, $K = 19.76\ (1 + 5.01 \times 10^{-4}\ t)$, from 600° to 1,550° F. Considerable confidence is placed in the results from 600° to 1,000° F; however, increased scatter in the data was encountered from 1,000° to 1,550° F. From considerations of many sources of error, the maximum error in conductivity

was estimated to range from ±8% to ±15% from the lower to the higher temperatures. At the melting point, the present values, previous results, and predicted values agree to within ±7%. From a broad extrapolation of the present data to the calculated critical conductivity, the conductivity of the molten lithium appears to reach a maximum of 45 Btu/hr·ft·°F at 3,200° F. I.v.L.

N64-14099 Picatinny Arsenal, Dover, N. J. Propellants Lab.
THE HEAT OF FORMATION OF HEXAUREA ALUMINUM III PERCHLORATE
Charles Lenchitz and Gayton Silvestro Jun. 1963 15 p refs (PA-TM-1295; AD-426958)

Hexaurea Aluminum III perchlorate burns smoothly in a combustion bomb leaving an α Al_2O_3 residue. Calculation of the heat of formation from the reaction: $C_6H_{24}O_{18}Cl_3N_{12}$ Al(s) + 30_2(g) + 1789.5 H_2O(l) → $6CO_2$(g) + $6N_2$(g) + 1/2 Al_2O_3(c) + 3(HCl·600 H_2O) gives a value of −691.53 kcal/mole at constant pressure and 25° C. Author

N64-14115 Aeronautical Systems Div., Wright-Patterson AFB, Ohio
THERMAL INSULATIONS FOR AEROSPACE APPLICATIONS, −423° TO +3000° F
M. L. Minges Sep. 1963 32 p refs Presented at the ASD Sci. and Eng. Symp., Wright-Patterson AFB, Ohio, 18–19 Sep. 1963
(ASD-TDR-63-699; AD-425704)

Advances in thermal insulation developments for the temperature range from liquid hydrogen (−423° F) to +3000° F are reviewed. Discussion of convective, conductive, and radiative heat transport mechanisms over this wide temperature range is included in analyzing the observed thermal characteristics of various insulation materials and composites. Variations in overall thermal conductance as a function of such parameters as absolute temperature level, interstitial gas pressure, density, radiation scattering and attenuation, and insulation geometry are discussed for recently developed powders, fibers, foams, and multilayer composites. Recent experimental results of USAF programs on these types of materials are presented and analyzed. Author

N64-14116 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Materials Lab.
THERMAL DIFFUSIVITY OF SOLIDS UTILIZING OPTICAL LASER ILLUMINATION Technical Documentary Report, Dec. 1 1962-Jul. 1, 1963
Gary L. Denman Oct. 1963 28 p refs
(ASD-TDR-63-882; AD-425614)

The application of the flash technique for measurement of thermal diffusivity of solid materials at high temperatures is discussed. The use of the technique, its limitations, and particularly the analytical difficulties encountered in considering high-temperature radiation losses and specimen diathermancy are reviewed. The design of a high-temperature thermal diffusivity apparatus is outlined that uses a ruby laser pulse source, an indium-antimonide infrared detector system, and a high-temperature tantalum furnace. Author

N64-14150* California U., Berkeley.
RADIATIVE ENERGY TRANSFER TO THE OUTER BASE REGION OF A SEMI-INFINITE CYLINDRICAL GAS BODY
C. L. Tien and M. M. Abu-Romia N.Y., Am. Inst. of Aeron. and Astronautics [1964] 11 p refs Presented at the AIAA Aerospace Sci. Meeting, New York, 20–22 Jan. 1964
(NASA Contract NAS8-850)
(AIAA Paper-64-60) AIAA: $0.50 members, $1.00 nonmembers

The radiative energy transfer to the base regions of a rocket from exhaust plumes is studied analytically by considering the radiation from semi-infinite cylindrical gas bodies of uniform temperature and composition. The effect of nozzle shielding is considered. For semi-infinite cylindrical gas bodies of small absorption coefficient, two asymptotic formulas obtained by direct integration are given. Numerical results are presented for the spectral apparent emissivity as a function of the spectral absorption coefficient, the height of shielding, and the radial distance in the base plane from the gas body. An approximate method for calculating the total apparent emissivity with any given infrared absorption spectrum of the gas is illustrated by the calculation of the total apparent emissivity for semi-infinite cylindrical gas bodies of CO_2 and H_2O at high temperatures. Author

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-13499 Dornier-Werke G.m.b.H., Friedrichshafen (W. Germany)
PILOTAGE OF HELICOPTERS WITH REACTION PROPULSION [PILOTIER-BARKEIT DES REAKTIONGSHUBSCHRAUBERS]
Laufer 24 Sep. 1963 17 p refs in GERMAN Presented at the meeting of the Wiss. Ges. Luft- u. Raumfahrt, Munich, 1963

Pilotage, a man–machine concept, concerns the attitude of the helicopter in response to the pilot during various maneuvers on the ground and in the air, as well as the handling required for accomplishing certain flight figures. This report discusses: pilot selection, attitude of the aircraft on the ground, hovering, forward flight, reverse flight, sideward flight, wind effects on the propellers, autorotations, and altitude flight with overloading during starting. I.v.L.

N64-13608 Human Factors Research, Inc., Los Angeles, Calif.
GEOGRAPHIC ORIENTATION IN AIRCRAFT PILOTS: A PROBLEM ANALYSIS
James J. Mc Grath and Gail J. Borden Nov. 1963 114 p refs (Contract Nonr-4218(00))
(Tech. Rept. 751-1; AD-426256)

The initial phase of a research program, having an ultimate goal of identifying the factors that produce geographic disorientation in aircraft pilots and of developing a body of empirical data relevant to the design of navigation displays and aeronautical charts, is discussed. Major problem areas for pilots, as indicated by the causes of geographic disorientation under low-altitude, VFR flight conditions, included the following: (1) faulty selection, detection, and identification of visual checkpoint references; (2) faulty dead-reckoning procedures and poor aircraft control in flight; (3) deficiencies in chart information, chart interpretation, and chart handling; (4) adverse weather conditions; (5) inadequate preflight planning; (6) deficiencies in flight-instrument design and in instrument

reading; and (7) individual differences in pilot skills, attitudes, and judgment. An outline of a program of research on these problems is described. P.V.E.

N64-13656 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
FORM PERCEPTION IN VIDEO VIEWING: EFFECTS OF RESOLUTION DEGRADATION AND STEREO ON FORM THRESHOLDS
Norman E. Freeberg Bedford, Mass., AF Systems Command, Dec. 1962 48 p refs
(Contract AF 19(628)-328)
(ESD-TDR-63-136; AD-285491)

Thresholds for video viewing of randomly constructed forms are determined under conditions of pictorial degradation and stereoscopic presentation. Form recognition is not significantly enhanced by stereo viewing, but discrimination threshold is reduced. All form thresholds are highly sensitive to video image degradation. Video acuity is not significantly related to video form thresholds and can be affected by orientation of a pattern in relation to video scan lines. Author

N64-13846 Hughes Aircraft Co., Fullerton, Calif.
A STUDY OF VISUAL DISPLAY ENHANCEMENT AND TECHNIQUES OF COLOR FILTERING
Robert J. Hall, James G. Miller, Dennis Musselman, Robert Earl, and Marvin H. Detambel Bedford, Mass., Decision Sci. Lab., Dec. 1963 47 p refs
(Contract AF 19(628)-2906)
(FR-63-11-287; ESD-TDR-63-635; AD-426265)

This report describes an investigation of target detection as a function of the spectral partitioning of light energy received from multicolored scenes which contain the targets and as a function of observer opportunity to manipulate certain viewing conditions. One group of observers viewed black and white photographs taken without optical filtering. Two others viewed black and white photographs taken through blue and orange-yellow filters. Observers in one of the latter groups were given complete control of the display facilities, permitting them to view the orange-yellow and blue filtered images singly, alternately, or superimposed. Observers in the other group had more limited control of the display; they could view the two filtered images singly, changing from one to the other as often as desired, but with a brief pause between images. Viewing the two filtered photographs proved superior to viewing the unfiltered one. Differences resulting from the two degrees of display control were small but favored the condition of more complete observer control. Author

N64-13872 RCA Service Co., Inc., Camden, N.J.
TECHNIQUES OF PHYSIOLOGICAL MONITORING. VOLUME II: COMPONENTS
Richard Alnutt and Philip T. Weinberg Wright-Patterson AFB, Ohio, Biophysics Lab., Nov. 1963 272 p refs
(Contract AF 33(657)-9252)
(AMRL-TDR-62-98(2); AD-426816) OTS: $4.00

This volume surveys the components used in physiological monitoring systems, primarily those suitable for aerospace applications. Discussion includes performance characteristics and capabilities, plus some background theory, on basic components such as electrodes and transducers, signal modifiers, and graphic recording and display devices. The use of magnetic tape recorders in instrumentation is described. Wire and radio transmission equipment is discussed, plus various schemes of modulation and multiplexing. The capabilities of digital and analog computers and other data processing equipment are described, and the analysis of physiological data with such equipment is briefly discussed. Author

N64-13873 Air Force Systems Command, Wright-Patterson AFB, Ohio
WALKING RESPONSES UNDER LUNAR AND LOW GRAVITY CONDITIONS
James F. Roberts (M.S. Thesis—AF Inst. of Tech., 1962) Nov. 1963 127 p refs
(AMRL-TDR-63-112; AD-426837) OTS: $2.75

A motion picture (time-displacement) walking experiment was conducted at various artificial gravity levels in an aircraft flying in parabolic trajectories. Two subjects walked on a floor-marked distance scale. Successive lowering of the gravity level from 1.0 g to 0.1 g produced the following effects. The subjects maintained within 10 percent of their normal 1-g velocity to gravity levels of 0.25 g or below. The most consistent effect of the reduction of gravity was the increased swinging time of the leg, which varied inversely as the sixth root of the gravity level. The increasing swing-to-support ratio indicates the decreasing control of progression. The discontinuity in the performance curves in the region of 0.2 g tends to substantiate previous estimates of the lower gravity limit for walking. Author

N64-13972 Philco Corp., Palo Alto, Calif. Western Development Labs.
HUMAN ENGINEERING DESIGN CHECK LIST
1 Feb. 1963 56 p refs
(Contract AF 04(695)-113)
(WDL-TR1968; AD-299282)

A test checklist is presented, which provides an indication of the extent to which the equipment detail design complies with human-engineering criteria specified in MIL-STD-803 (USAF), that is a part of the acceptance test plan for MUSAP. The visual-inspection checklist is concerned with the mechanical operation, location, arrangement, form, readability, and coding of controls and displays. Power is applied to the equipment to check control interlocks and multicolor displays. The function checklist is concerned with the functions and the interaction of controls and displays. Equipment acceptance-test specifications are used as the reference for monitoring this portion of the test. The test includes monitoring of equipment activation, checkout, normal operation, manual override operation, and shutdown. Particular attention is given to the operations sequence and information feedback. In addition, the test checklist is to be used as a human-engineering design guide. I.v.L.

N64-14147 Joint Publications Research Service, Washington, D.C.
PHYSIOLOGY OF THE ACT OF ATTENTION
V. I. Patrushev and V. G. Zhukov 24 Jan. 1964 10 p refs Transl. into ENGLISH of an article from Vop. Psikhologii (Moscow), no. 5, 1962 p 70–74
(JPRS-22892; OTS-64-21386) OTS: $0.50

The physiology of the act of attention was investigated. Students between the ages of 12 and 17 were the test subjects. Results indicate that: (1) The level of excitation of the nervous system fluctuates regularly within short time intervals. (2) This large-scale study of juveniles under uniform conditions revealed three types of changes in the duration of latent periods of motor reaction in response to successive stimuli

causing the act of attention: (a) successive reduction of the duration of long latent responses, (b) insignificant variations of latent responses of medium duration, and (c) successive increase of short latent periods. The preponderance of the second type of change, (b), for all subjects studied, and also the dampening of extreme durations of latent periods in the course of perception, suggests that the optimum excitation of the subjects for perception lies in the limits of medium values of latent periods of motor reaction. I.v.L.

N64-14168 Washington School of Psychiatry, D. C.
THE EFFECT OF A PARTICULAR STRESS ON ONE MAN'S PERFORMANCE OF VARIOUS TRACKING TASKS Interim Report
Hamilton Mowbray, Lewis Durr (Applied Physics Lab.), Elizabeth De Socio, and Norman K. Walker Sep. 37 p refs
(Contract DA-49-193-MD-2369)
(AD-428112) OTS: $3.60

The present report investigates the effect for an acceleration control tracking task over a wide range of control stiffnesses (8.3 to 915.0 mils/sec^2) and control lag (0.0 to 1.255 sec). The results indicate, as a working hypothesis: (1) that the percentage increase in error due to control lag, and due to auditory shadowing is independent of control stiffness. (2) that the effect of auditory shadowing is small (40% to 50% increase in error) with no lag, but very great (over 200% increase in error) if the lag is 0.3 sec or more; (3) that under conditions where severe degradation of the tracking task occurs, the accuracy of the auditory shadowing is also seriously degraded. Author

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-13456 Royal Air Force, Farnborough (Gt. Brit.) Inst. of Aviation Medicine
INSTRUMENTATION AND THE HUMAN CENTRIFUGE
G. H. Byford *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 42–51 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

After defining exactly the force producing the acceleration and specifying the experimental conditions, the author considers the instrumentation in relation to the experimentation and reviews some of the most recent techniques: closed circuit television, electroencephalography, blood tests, magnetic band measurements, "computers", etc. and finally the mathematical analysis of the results. Author

N64-13572 Joint Publications Research Service, Washington, D.C.
GYROSCOPIC TACHOMETERS AND TACHOACCELEROMETERS WITH PRESSURE PICKUPS
A. A. Odintsov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 62–71 (See N64-13565 05-01) OTS: $3.00

Advantages are cited for using electrical pressure-pickups instead of angle-data transmitters in gyroscopic tachometers and tachoaccelerometers that are designed for measuring abruptly changing speeds and accelerations. Pressure-pickups perform simultaneously the functions of elastic units. Using a gyrotachometer with a wire strain-gage as an example, a method is shown for designing such devices, and the ability is illustrated for obtaining a high frequency of the device's own oscillations without impairing the conditions needed for converting the motion of the movable part of the device into an output electrical signal. Author

N64-13576 Joint Publications Research Service, Washington, D.C.
MOTION OF RUBBER-CUSHIONED INSTRUMENT MECHANISM DURING IMPACT TESTS
V. S. Novoselov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 125–134 refs (See N64-13565 05-01) OTS: $3.00

Equations are derived for relative displacements and absolute accelerations of longitudinal, lateral, and rotary vibrations of a measuring mechanism located in an instrument on a rubber shock absorber, and subjected to impacts with the shock absorber operating in a linear range of deformations. Conclusions are made about the optimal selection of shock absorbers for impact-resisting instruments. Author

N64-13581 Joint Publications Research Service, Washington, D.C.
MULTI-RANGE POTENTIOMETER BRIDGE
G. P. Buynyachenko *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 184–186 (See N64-13565 05-01) OTS: $3.00

A device which combines the features of a bridge and a potentiometer is described. This device is based on an electronic self-recording potentiometer, and assures high precision without increasing the sensitivity of the amplifier. The device can be used as a multirange potentiometer as well as a balanced multirange bridge. A wiring diagram is included. R.T.K.

N64-13687 Joint Publications Research Service, Washington, D.C.
AUTOMATIC ELECTRON POLARIMETER AND OTHER DEVICES
L. V. Ksanfomaliti *In its* New Methods in Astronomy 10 Jan. 1964 p 116–129 refs (See N64-13676 05-01) OTS: $3.00

A high-speed polarimeter was developed that is capable of performing the appropriate calculations and also of indicating the degree of polarization in percentages and the angle of location of the polarization plane in degrees within a very wide range of brightnesses of the object being studied. An automatic electron photometer was developed for the recording of very slight light fluxes during work with a 700-mm meniscus telescope. A parametric stabilizer which is recommended for use when it is necessary to maintain the constancy of speed of d.c. motors is also described. R.T.K.

N64-13688 Joint Publications Research Service, Washington, D.C.
STELLAR PHOTOMETER AND SPECTROMETER FOR THE 1-2.5 MU REGION
V. I. Moroz *In its* New Methods in Astronomy 10 Jan. 1964 p 130–141 refs (See N64-13676 05-01) OTS: $3.00

A description is presented of a stellar photometer and of an infrared spectrometer. Both instruments were used with two types of radiation receivers—a sulfur-lead photoconductive cell and a germanium barrier-layer cell. The instruments operated at the temperature of dry ice and for this reason were mounted in Dewar vessels. P.V.E.

N64-13689 Joint Publications Research Service, Washington, D.C.
FABRY-PEROT STANDARD WITH AN IMAGE AMPLIFIER FOR OBSERVATION OF LOW-EMISSION OBJECTS
P. V. Shcheglov *In its* New Methods in Astronomy 10 Jan. 1964 p 142–147 (See N64-13676 05-01) OTS: $3.00

The use of vacuum-type image intensifiers with optical output for observing weak emissive nebulae is discussed. P.V.E.

N64-13722 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
INTERNAL FOUR-CHANNEL PHYSIOLOGICAL TELEMETRY SYSTEM PROTOTYPE DEVELOPMENT [Final Report]
L. N. Wright Los Angeles, AFSC, Jul. 1963 66 p refs
(Contract AF 04(695)-119)
(SID-63-633; SSD-TDR-63-153; AD-420179)

A miniature, multichannel, micro-powered biotransensor and its attendant receiving system were developed. The biotransensor included a four-channel telemetry transmitter and sensors designed to monitor body temperature, respiration rate, cardioelectric activity, and blood pressure. The results of the program show that a system, as described above, can be made to operate in excess of 90 days and transmit simulated physiological data with a good degree of accuracy, and that through further research miniature long-lived, multichannel biotransensors may be developed which will make possible the long-term monitoring of animals in stressful environment. Significant results are presented in this report, as well as recommendations for development of future, miniaturized, multichannel bioinstrumentation systems, capable of operating in excess of one year. Author

N64-13773 Lear Siegler, Inc., Grand Rapids, Mich.
HYDROKINETIC SENSING TECHNIQUE STUDY [Final Report, Feb. 1962-Feb. 1963]
W. Carrington Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Sep. 1963 85 p
(Contract AF 33(657)-7990)
(GR-1425; ASD-TDR-63-467; AD-415482)

This effort was to determine the feasibility of suspending a research model of a hydrokinetic rate sensor by electrostatic force, eliminating mechanical bearing noise so that the threshold-rate sensing capabilities of the device might be studied. Although the design problems, such as transmitting the rate signal across the electrode gap by a noncontacting means, were solved, the complexity and expense of the electrostatic suspension preclude its use in this application. The theory of its operation is developed, however, as represented by a nonlinear mathematical model and as confirmed by laboratory experiments. An analog simulation is evolved upon which future electrostatic support systems may be evaluated. Author

N64-13781 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
AN EXPERIMENT ON THE STRAIN OF SONDE ANEROID BAROMETER
13 Dec. 1963 8 p ref Transl. into ENGLISH by JPRS from Kirshocho Kenkyu Jiho (Tokyo), v. 10, 1958 p 70–72
(RSIC-110; AD-426828)

When barometric measurements are performed with a radiosonde oscillator, there are errors in the measurement as a result of residual effects from previous measurements. The residual effects are unavoidable as long as an aneroid barometer is used. The possibility of minimizing these residual effects was investigated. Results indicate that a standing period of from 6 to 9 hours, without use, is necessary to minimize the effect. R.T.K.

N64-13888 Lockheed-Georgia Co., Marietta
ESTABLISH THE GENERAL USE OF CERAMIC TOOLS IN PRODUCTION Interim Report
C. M. Head 4 Jan. 1963 28 p refs
(Contract AF 33(600)-36888)
(GMRI-660.02; AD-427697)

Three ceramic mold dies and three layup blocks are now used in production. The hot sizing die is being modified after satisfactorily completing a large production order. The release of fiberglass parts from the tool has been facilitated through the development of a pressure-actuated air jet valve and an improved release agent. Author

N64-13947 Iowa State U. of Science and Tech., Ames
NEW DESIGN OF A COMPLETELY AUTOMATED HIGH PRECISION CURVED-CRYSTAL SPECTROMETER
Hans Toffer (M. S. Thesis) and E. N. Hatch Nov. 1962 52 p refs
(Contract W-7405-eng-82)
(IS-575) OTS: $1.50

The need for precision gamma-ray energy determinations and the justification for developing curved-crystal gamma-ray spectrometers are discussed. A short history of the development of these spectrometers is given, followed by a listing of existing instruments with their appropriate characteristics and capabilities. The proposal for an automated curved-crystal spectrometer constitutes the main body of the paper. Special emphasis is placed on the application of the Razdow Laboratory Midarm (Micro Dynamical Angle and Rate Monitor) System and the on-line IBM-1710 Control and IBM-1620 Data Processing System. An extensive bibliography and a listing of single-crystal producers, precision angle-measuring devices, and positioning tables are presented. Author

N64-14033 Stanford Research Inst., Menlo Park, Calif. Poulter Labs.
PRESSURE TRANSDUCER FOR MEASURING SHOCK WAVE PROFILES Final Report
D. D. Keough 1 Nov. 1963 52 p refs
(Contract DA-49-146-XZ-096; Proj. Vela-Uniform)
(DASA-1414; AD-426910)

Calibration of pressure gages consisting of Manganin wire cast in epoxy or doped epoxy insulators shows that $R(P)$ is linear within experimental errors up to the highest calibration pressures obtained, ~200 kb. Hysteresis seems to be nonexistent, as does the temperature dependence of $R(P)$. These gages functioned satisfactorily in nuclear field tests where peak pressure and rate of pressure decay were obtained. Long duration recording failed for reasons other than anticipated. A technique for obtaining Hugoniot and cross characteristic data with the

pressure gage was used satisfactorily. A general technique for examining the piezoresistive behavior of conductors at high pressures has also been developed. Author

N64-14039 Air Force Cambridge Research Labs., Bedford, Mass.
OBSERVATION AND IDENTIFICATION OF ION DISSOCIATION PROCESSES OCCURRING IN THE DRIFT TUBE OF A TIME-OF-FLIGHT MASS SPECTROMETER
W. W. Hunt, Jr., R. E. Huffman, and K. E. Mc Gee (Wentworth Inst.) Sep. 1963 18 p 2 refs
(AFCRL-63-707)

The shifts in ion flight times produced by a flat-top potential barrier applied within the drift tube of a time-of-flight mass spectrometer are defined analytically in terms of the height of the potential barrier. These flight-time shifts are selectively dependent on the mass, charge, and kinetic energy of the ions involved; consequently, they can be used to separate and identify the products of ion dissociation processes occurring in the drift tube. Comparisons of calculated and observed flight-time shifts for the $58^+ \rightarrow 43^+$, 42^+ dissociations in n-butane are used to illustrate the applicability and present limitations of this method of identifying dissociation products. Author

N64-14062* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED PRECISION HEIGHT GAGE
Lester B. Vale Washington, NASA, Office of Technol. Utilization, Nov. 1963 13 p
(NASA SP-5001) OTS: $0.50

Although the principle used in the gage is not radically new, the design and construction result in performance and accuracy superior to those of previous similar devices. It may be accurately set to a desired height without auxiliary measuring devices; there is no lost motion in the movement of the upper block; and the resolution of the instrument is improved by fully utilizing the mechanical advantage inherent in the sliding-wedge principle. Author

N64-14078 European Atomic Energy Community, Brussels (Belgium)
ABSOLUTE DETERMINATION OF THE U-235/U-238 RATIO WITH AN OPTICAL INTERFEROMETER (HYPEAC)
C. Berthelot and K. F. Lauer Joint Nucl. Res. Center, Geel Estab. (Belgium), Sep. 1963 28 p refs
(EUR-307.d) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 40 Belg. Fr.

An optical method for the absolute determination of the isotope ratio of U-235–U-238 is described. The recording of the homologous lines of uranium is done by a photoelectric Fabry–Perot interferometer (Hypeac). A series of samples of uranium oxides containing from 3% to 93% of U-235 (NBS standards) has been analyzed, and the results agree to within ±0.70% with those given by the National Bureau of Standards. The relative precision of the method is of the same order—±1% at the 99% confidence level. Author

N64-14081* Princeton U. Observatory, N.J.
PLANS FOR PLANETARY OBSERVATIONS WITH STRATOSCOPE II
Robert E. Danielson Repr. from Mem. Soc. roy. sci. Liege, ser. 5, v. 7, 1963 p 241–246
(Sponsored by NASA, ONR, and NSF)

Stratoscope II is a balloon-borne telescope which will have high resolution photography of the planets as one of its goals. The height of the instrument is about 25 feet, and its weight is about 3 tons. The primary optical element is a 36-inch fused silica mirror. The signals for the pointing system are provided by two guide stars located within 25 minutes of arc of the region to be photographed. These (9th magnitude or brighter) guide stars are detected by two retrodividers located in the f/50 focal plane of the telescope. The Stratoscope II will be used for infrared spectroscopy as well as for high resolution optical photography. P.V.E.

N64-14096 Aerojet-General Corp., Sacramento, Calif.
WEAPON SYSTEM 133A; QUALIFICATION TEST REPORT FOR STATHAM ABSOLUTE PRESSURE TRANSDUCER Final Report
R. W. Armstrong 27 Dec. 1963 183 p refs
(Contract AF 33(600)-36610)
(Rept. 0162-01DR-26; AD-426920)

Absolute pressure transducers, Model PA334TC-2.5, were subjected to performance, frequency response, motor static firing, and safety reliability tests. The remainder of the qualification tests, including vibration, acceleration, temperature-altitude, altitude, humidity, hermetic seal, radiofrequency, interference, and performance reliability, were performed on transducer Model PA334TC-750 and are considered applicable to Model PA334TC-2.5M based on the similarity of the two parts. Successful completion of the tests has qualified the transducer for use on second-stage Minuteman motors. Author

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-13452 Deutsche Versuchsanstalt für Luftfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin
THE HUMAN CENTRIFUGE AND ITS APPLICATION TO PILOT SELECTION
S. Ruff *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 1–13 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

The human centrifuge had to fulfill various technical demands: (1) a maximum acceleration of 40 g; (2) a wide range of acceleration rates, from 0.01 g/sec to about 20 g/sec, adjustable by hand as well as automatically; (3) a diameter not wider than 16 m; (4) different arms provided for different purposes; (5) a sufficient quantity of collector rings provided for transmission. A short survey is given of the special technical devices chosen in order to satisfy these demands. The paper also deals with the centrifuge as selection instrument. A choice reaction-time test with visual and auditory stimuli was used to study efficiency impairment under acceleration. The purpose of the studies was to predict blackout-level time by means of reaction-time increase. The findings under acceleration were mostly negative. Most of the subjects showed no sign of disorder compared with their response in a nonstress situation; only some of the subjects showed greater decrement shortly before they experienced blackout or collapse. Author

N64-13453 Royal Canadian Air Force, Toronto
SOME RECENT DEFINITIONS OF THE ACCELERATION PROBLEM
W. R. Franks *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 14–22 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Accumulated experience with accelerations and means of protection against these have served to define more closely some of the limiting factors concerned with this variant of modern man's environment. With the present g suit, body-surface protection where adequate hydrostatic gradient is accomplished still implies an increased load on the unprotected heart which may be limiting, although gaseous increased intrathoracic pressure can minimize this. Complete fluid protection imposes problems of tactile sensation and orientation which can be troublesome. Discomfort from anatomical distortions within the thoracic cage can be limiting, especially from transverse accelerations. Other differences in specific gravity within the body also must be considered, especially with high or prolonged acceleration. These include difference in specific gravity between brain and cerebrospinal fluid, possible centrifugal sludging of blood, and reciprocal shifts in body fluids generally. Reflex endocrine and vasomotor responses to these shifts may prove embarrassing when an increased g subsides. Author

N64-13454 Defense Research Medical Labs., Toronto (Canada)
A REVIEW OF THE PHYSIOLOGICAL EFFECTS OF ANGULAR ACCELERATIONS
W. H. Johnson and N. B. G. Taylor *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 23–34 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

The known and possible physiological effects of angular (rotational) accelerations are reviewed in relation to the production of motion-sickness, spatial disorientation and "blackout" by centrifugal acceleration. The characteristic accelerations of physiological significance produced by swings, turntables, centrifuges and a linear vertical accelerator are described. The bearing of these factors on present flying conditions and on some proposals for future operations are discussed, and a preliminary report is given on some recent experiments in cats to clarify the function of the utricle and the saccule. Author

N64-13455 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
HUMAN TOLERANCE AND LIMITATIONS TO ACCELERATION
Robert N. Headley *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 35–41 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Work being conducted concerning accleration effects on primates is discussed. Some results are presented of work with the following types of acceleration: headward acceleration (positive g), forward acceleration, sideward or lateral acceleration, footward acceleration (negative g), backward acceleration, and complex accelerations (combinations of various accelerations and oscillations). P.V.E.

N64-13457 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
CENTRIFUGE METHODS AND TECHNIQUES IN THE U.S. NAVY
F. K. Smith *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 52–58 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

The following are discussed: (1) the characteristics of the centrifuge and its use as a flight simulator, (2) terminology, (3) current survey on the subject with reference to testing, mounting and means of restraint, (4) physiological measurements, and (5) performance evaluation. Author

N64-13458 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
END POINTS FOR ACCELERATION TOLERANCES ON THE CENTRIFUGE
M. G. Webb *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 59–64 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

A discussion is presented of ways in which man's physical tolerance to acceleration can be increased. It is concluded that the results of preliminary tests with water-immersion systems indicate that not only man's physical tolerance but his task performance as well will be increased with refinements in such advanced protective systems. P.V.E.

N64-13459 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
A DISCUSSION ON RESTRAINT AND PROTECTION OF THE HUMAN EXPERIENCING THE SMOOTH AND OSCILLATING ACCELERATIONS OF PROPOSED SPACE VEHICLES
Carl C. Clark and R. Flanagan Gray *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 65–95 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

The thesis maintained in this report is as follows: It is not the forces resulting from acceleration or deceleration (up to about 30g) that are harmful to man, but it is the asymmetrical reactions on the body resulting from the lack of equilibrium in the action of those forces. Owing to adequate external protection, the tolerance of the human being depends to a greater extent on the effects of local compression or expansion on the tissues than on the results of generalized displacements or distortions of the tissues and organs. Author

N64-13460 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
THE EFFECTS OF FORWARD ACCELERATION ON RESPIRATION
William G. Blanchard *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 96–100 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Respiratory embarrassment has previously been found to limit human tolerance to prolonged transverse acceleration. Various aspects of the respiratory abnormalities engendered by headward and transverse acceleration have been studied. Quantitative measurements have been made of the degree of respiratory impairment, and roentgenographic study made of the abnormal intrathoracic organ relationships. These experimental results and roentgenograms are reviewed, and their implications discussed. Author

N64-13461 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
THE PHYSIOLOGICAL EFFECTS OF ACCELERATION ON RESPIRATION AND PROTECTIVE MEASURES

Alvin S. Hyde *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 101–106 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Numerous alterations in respiratory physiology occur during forward $+a_x$ acceleration. All lung volumes decreased proportionately with the exception of residual volume which does not change at 4 g. The midpulmonary position falls, and maximum breathing capacity and functional residual capacity decrease. Although alveolar ventilation is maintained, arterial desaturation occurs due to venous admixture, probably resulting from unequal perfusion–ventilation relationships. Intrapulmonic pressure increases for a constant volume, thus shifting static relaxation pressure volume curves progressively to the right, resulting in an increase in the elastic work of breathing. Dynamic pulmonary compliance decreases as a result of the fall in pulmonary midposition and functional residual capacity. Positive pressure breathing has significantly corrected some aspects of the abnormal physiology and has significantly increased time tolerance to forward $+a_x$ accelerations. Studies of optimal back angle suggest that 10° to 15° of forward inclination will require the least respiratory work. Author

N64-13462 Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris (France)

EFFECTS OF REPEATED POSITIVE ACCELERATIONS OF LOW INTENSITY AND LONG DURATION. ANATOMICAL STUDY ON THE DOG KIDNEY [EFFETS DES ACCELERATIONS POSITIVES REPETEES DE FAIBLE INTENSITE ET LONGUE DUREE ETUDE ANATOMIQUE SUR LE REIN DE CHIEN]

R. Senelar, R. Loubiere, and F. Violette *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 107–118 refs In FRENCH; ENGLISH summary (See N64-13451 05-01) Pergamon Press: $10.00

Repeated exposures of dogs to a positive acceleration of 2.5 g a day, up to a total of 10 to 60 hr, produced macroscopic and microscopic injuries in the kidneys, marked by venous and capillary congestion, glomerular congestion, and tubular vacuolization, especially in the low nephron, with infiltration of iron ochre pigment from the blood. Three months later, instead of these injuries, an invading sclerosis is observed, which leads eventually to the disappearance of the glomerule. This process offers three stages: relative tolerance, submission, aggravation. Author

N64-13463 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

CARDIOVASCULAR EFFECTS OF FORWARD ACCELERATION

Gustave C. E. Mueller *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 119–129 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

During forward acceleration, the venous return afforded by body positioning is sufficient for the heart to perform adequately. There appears to be no impairment of the central blood pump's ability to maintain an adequate blood pressure and volume flow. The systemic distribution of cardiac output may cause small degrees of insufficiency, for example, ischemic neuropathy in elevated legs, but so far, no major problems have been encountered. The pulmonary blood flow distribution is probably one of the most critical factors limiting tolerance to forward accelerations of longer duration. The arterial blood desaturation now observed seems most probably due to regional variations in the ventilation–perfusion ratio, normal maintenance of which is necessary for proper arterialization. Defects in pulmonary diffusion may be equally disabling, although they seem to persist only during acceleration and are probably not impaired permanently. Author

N64-13464 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

HOST FACTORS IN RESISTANCE TO ACCELERATION STRESS

E. R. Stiehm *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 130–139 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Four methods to increase resistance to acceleration stress are drugs, conditioning, hypophysectomy, and reticuloendothelial stimulation. Reticuloendothelial stimulation is a simple, relatively safe method to increase acceleration tolerance without radical alteration in physiology. This method is discussed, and a common mechanism for increased acceleration tolerance is proposed involving alterations in steroid metabolism mediated via the hypophyseal-adrenal channel. Author

N64-13465 Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris (France)

ADVANTAGE AND LIMITS OF RESEARCHES CARRIED OUT ON ANIMALS AND ON MAN BY MEANS OF CENTRIFUGES [INTERET ET LIMITES DES RECHERCHES EFFECTUEES SUR L'ANIMAL ET SUR L'HOMME AU MOYEN DES CENTRIFUGEUSES]

R. Grandpierre, F. Violette, R. Flandrois, and J. B. Tosan *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 140–146 In FRENCH; ENGLISH summary (See N64-13451 05-01) Pergamon Press: $10.00

Following a brief history of the centrifuge since Darwin (1794), the use of centrifuges for studying long duration g is discussed, as well as the technical limitations, especially when extremely rapid accelerations are involved. The limitations of the evaluation of data obtained are emphasized. The difference between the 2-foot vertical attitude of man and the 4-foot horizontal attitude of the animal is not only of an anatomic nature, but orthostatism physiologically results in important vascular regulations; this implies much caution in the evaluation of data obtained. Author

N64-13466 Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

MEDICAL MACHINE RECORD CARDS – THEIR DEVELOPMENT AND USE IN THE ASTRONAUT SELECTION PROGRAM

A. H. Schwichtenberg, Donald D. Flickinger (AFSC, Andrews AFB, Md.), and W. Randolph Lovelace II *In* Advisory Group for Aeron. Res. and Develop., Paris Bio-Assay Tech. for Human Centrifuges and Physiol. Effects of Acceleration 1961 p 147–173 refs FRENCH summary (See N64-13451 05-01) Pergamon Press: $10.00

Special-mark sense-type machine record cards were developed to record complete medical history, special aviation history, physical examination and various specialists examinations, radiological and laboratory tests, as well as physiological data. In order to similarly record the results of stress tests, cards were developed for recording heat tolerance, tolerance to g forces on the centrifuge, altitude tolerance in a partial pressure suit, tilt table test, cold pressor test, and tracking under high noise levels. Cards were also developed to record complete anthropological data and various psychological variables. All data on the astronaut candidates were recorded in this manner. Author

N64-13474 Argentina. Comision Nacional de Energia Atomica, Buenos Aires
DETERMINATION OF THE SOLUBILIZED PHOSPHORUS IN THE MICROORGANISMS OF THE SOIL [SOLUBILIZACION DE FOSFATOS POR MICROORGANISMOS DEL SUELO]
Anibal H. Merzari, Sergio Flores Suarez and Alicia Godoy 1963 8 p refs In SPANISH; ENGLISH Summary
(*Its* Informe 93)

A rapid and simple technique has been developed for the quantitative determination of solubilized phosphorus by *B. subtilis* and *B. megatherium* from tricalcic phosphate. Using tricalcic labelled with P^{32}, the activity in the liquid medium is measured after a period of 8 days, and this result is related to the specific activity of the radioactive substance to obtain the amount of phosphorus brought into solution. Author

N64-13493 Advisory Group for Aeronautical Research and Development, Paris (France)
ESCAPE AND SURVIVAL, CLINICAL AND BIOLOGICAL PROBLEMS IN AERO SPACE MEDICINE
P. Bergeret, ed. New York, London, Pergamon 1961 121 p refs Book
(AGARDograph-52) Available from Pergamon Pr. $6.50

CONTENTS:

1. BIOLOGICAL PROBLEMS OF ESCAPE AT HIGH ALTITUDES H. L. Roxburgh p 1–4 refs

2. ESCAPE FROM AIRCRAFT AT HIGH SPEEDS AND LOW ALTITUDES F. G. Cumming p 5–9

3. PARACHUTIST'S SPIN PROBLEM O.Walchner p 10–17

4. ASPECT MEDICAL DES EJECTIONS PRATIQUEES EN FRANCE SUR DIFFERENTS TYPES DE SIEGES EJECTABLES J. Fabre p 18–29

5. FUNDAMENTAL CONCEPTS IN RCAF ARCTIC SURVIVAL TRAINING S. E. Alexander and J. G. Fraser p 30–45 refs

6. AVIATION MEDICINE CONSULTATION PROBLEM CASES C. A. Berry p 46–62 refs

7. EARLY DIAGNOSIS OF HYDROPS OF THE LABYRINTH R. N. Kraus p 63–81 refs

8. THERAPY OF SPONTANEOUS PNEUMOTHORAX IN RCAF FLYING PERSONNEL C. N. Burgess and D. G. M. Nelson p 82–88 refs

9. A BRIEF SURVEY OF THE ROLE OF ELECTIVE SURGERY IN A MODERN AIR FORCE J. W. Garraway p 89–93

10. THE CHOICE OF GAS MIXTURE FOR BREATHING IN HIGH PERFORMANCE AIRCRAFT J. Ernsting, G. J. R. McHardy, and R. L. Roxburgh p 94–103 refs

11. ANIMAL AND MAN IN THE SPACE ENVIRONMENT J. E. Pickering p 104–107

12. BIO-ASTRONAUTICS RESEARCH—WHAT SHALL WE SIMULATE? B. H. Lowi and T. J. Gallagher p 108–114

N64-13501 Chicago U., Ill. USAF Radiation Lab.
Quarterly Progress Report No. 49 [RESEARCH ON CERTAIN BIOLOGICAL AND MEDICAL ASPECTS OF ATOMIC ENERGY]
Kenneth P. Du Bois 15 Oct. 1963 125 p refs
(Contract AF 41(609)-1693)
(AD-422960)

CONTENTS:

THE EFFECTS OF IONIZING RADIATIONS ON THE BIOCHEMISTRY OF MAMMALIAN TISSUES

1. THE INFLUENCE OF X-IRRADIATION AND CHEMICAL AGENTS ON DETOXIFICATION MECHANISMS K. P. Du Bois and F. Kinoshita p 1–24 refs (See N64-13502 05-16)

2. INFLUENCE OF X-IRRADIATION ON THE DEVELOPMENT OF A THIOPHOSPHATE-OXIDIZING ENZYME SYSTEM IN THE LIVERS OF YOUNG MALE RATS B. E. Hietbrink and M. Keshmiri p 25–33 refs (See N64-13503 05-16)

3. THE INFLUENCE OF ORAL ADMINISTRATION OF MIXTURES OF VARIOUS RADIO-PROTECTIVE COMPOUNDS ON RADIATION-INDUCED CHANGES IN ENZYME ACTIVITIES IN CERTAIN RAT TISSUES B. E. Hietbrink, M. Keshmiri, and M. E. Hayward p 34–44 refs (See N64-13504 05-16)

PHARMACOLOGICAL OR TOXICOLOGICAL COMPOUNDS AS PROTECTIVE OR THERAPEUTIC AGENTS AGAINST RADIATION INJURY IN EXPERIMENTAL ANIMALS

4. THERAPY OF RADIATION INJURY IN MICE USING VARIOUS CHEMICAL AGENTS J. Dilley and J. Doull p 45–56 refs (See N64-13505 05-16)

5. HISTOPATHOLOGICAL FINDINGS IN THE TISSUES OF MICE PROTECTED AGAINST THE LETHAL EFFECTS OF WHOLE-BODY X-RAY EXPOSURE BY THE POST-IRRADIATION ADMINISTRATION OF SODIUM SULFITE OR A THIAZOLIDINE DERIVATIVE D. Vesselinovich, J. Dilley, J. Meskauskas, F. Fitch, and J. Doull p 57–69 refs (See N64-13506 05-16)

6. THE INFLUENCE OF VARIOUS CHEMICAL COMPOUNDS ON RADIATION LETHALITY IN MICE V. Plzak, M. Root, and J. Doull p 70–91 refs (See N64-13507 05-16)

INFLUENCE OF EXPOSURE TO LOW LEVELS OF GAMMA AND FAST NEUTRON IRRADIATION ON THE LIFE SPAN OF ANIMALS

7. EFFECTS OF PARTIAL BODY SHIELDING ON THE ACETYLATION OF SULFANILAMIDE IN CHRONICALLY IRRADIATED MICE A. Sandberg and J. Doull p 92–103 refs (See N64-13508 05-16)

8. CAGING AND HOUSING EFFECTS ON MORTALITY IN X-RAYED MICE D. G. Oldfield, V. Plzak, E. L. Simmons, and J. Doull p 104–114 (See N64-13509 05-16)

9. THE ANALYSIS OF RADIOPROTECTIVE EFFECTS IN PROTON- OR X-RAY-IRRADIATED MICE PRE-TREATED WITH CHEMICAL PROTECTORS D. G. Oldfield, V. Plzak, and J. Doull p 115–123 refs (See N64-13510 05-16)

N64-13502 Chicago U., Ill. USAF Radiation Lab.
THE INFLUENCE OF X-IRRADIATION AND CHEMICAL AGENTS ON DETOXIFICATION MECHANISMS
Kenneth P. Du Bois and Florence Kinoshita *In its* Quart. Progr. Rept., No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 1–24 refs (See N64-13501 05-16)

A summary is presented of research activities. Results include the following: (1) A procedure was developed for using the anticholinesterase action of DMP in adult female rats as a measure of the effects of chemicals and radiation on detoxification enzymes. (2) Administration of phenobarbital at a dose level of 25 mgm/kgm two times per day to adult female rats caused a marked decrease in the effectiveness of DMP as an inhibitor of cholinesterase. (3) The intraperitoneal administration of 100 mgm/kgm of nikethamide to adult female rats resulted in the development of a detoxification mechanism which markedly reduced the anticholinesterase action of DMP. (4) The intraperitoneal administration of 3,4-benzpyrene (25 mgm/kgm) to adult female rats caused induction of a detoxification mechanism. (5) The administration of

puromycin (35 mgm/kgm), an inhibitor of protein synthesis, prevented induction of the detoxification mechanism for DMP in adult female rats by phenobarbital and nikethamide. (6) The administration of nikethamide (100 mgm/kgm) or phenobarbital (25 mgm/kgm/day) to 23-day-old male rats caused a marked increase in the resistance to the anticholinesterase action of DMP. P.V.E.

N64-13503 Chicago U., Ill. USAF Radiation Lab.
INFLUENCE OF X-IRRADIATION ON THE DEVELOPMENT OF A THIOPHOSPHATE-OXIDIZING ENZYME SYSTEM IN THE LIVERS OF YOUNG MALE RATS
Bernard E. Hietbrink and Marjorie Keshmiri *In its* Quart. Progr. Rept. No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 25–33 refs (See N64-13501 05-16)

The results of studies concerning the influence of exposing relatively small areas of the body to X-irradiation on the development of phosphorothioate-oxidizing enzymes in the livers of young male rats are discussed. The results indicated that shielding the head and liver area provided a substantial reduction in the degree of inhibition caused by 200 r of X-irradiation. It was found that the administration of 200 r of X-ray to the testes area while shielding the remainder of the body caused a significant reduction in the normal rate of development of microsome oxidase activity. The development of the enzyme activity of the livers of animals given 400 r to the testes area was inhibited to an extent similar to that caused by 200 r of total-body radiation. Shielding the head while exposing the remainder of the body to 200 r of X-ray failed to reduce the inhibitory effect caused by a similar amount of total-body exposure. Administration of 200 r to the head while shielding the remainder of the body inhibited development of the drug metabolizing enzyme to a degree similar to that observed following 200 r or 400 r of total-body X-ray exposure. P.V.E.

N64-13504 Chicago U., Ill. USAF Radiation Lab.
THE INFLUENCE OF ORAL ADMINISTRATION OF MIXTURES OF VARIOUS RADIOPROTECTIVE COMPOUNDS ON RADIATION-INDUCED CHANGES IN ENZYME ACTIVITIES IN CERTAIN RAT TISSUES
Bernard E. Hietbrink, Marjorie Keshmiri, and Mary E. Hayward *In its* Quart. Prog. Rept. No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 34–44 refs (See N64-13501 05-16)

The summary of a study undertaken to obtain information concerning the influence of oral administration of serotonin and mixtures of serotonin and compounds containing sulfur on the radiation-induced changes in enzymes activities of the spleens, thymus glands, and small intestines of rats, and to determine the influence of certain orally administered agents on the 30-day survival of rats given lethal doses of X-irradiation included the following: (1) It was found that 20 mgm/kgm of serotonin, given from 3 to 15 minutes before irradiation, provided significant reductions in the biological effects of X-ray in the spleens, thymus glands, and intestines of rats. (2) The oral administration of a mixture of serotonin and AET failed to reduce the damaging effects of X-irradiation in the tissues studied to the extent afforded by serotonin alone—a mixture of serotonin and MEA provided substantial protection in the spleen when given 15 or 30 minutes before 400 r of X-ray, but failed to reduce the radiation-induced changes in the intestines. (3) Oral administration of 40 mgm/kgm of serotonin permitted survival of one of five rats given 850 r; oral injections of mixtures of 40 mgm/kgm of serotonin plus 500 mgm/kgm of MEA before exposure protected 20% of the animals against the lethal effects of 850 r of X-irradiation. P.V.E.

N64-13505 Chicago U., Ill. USAF Radiation Lab.
THERAPY OF RADIATION INJURY IN MICE USING VARIOUS CHEMICAL AGENTS
J. Dilley and J. Doull *In its* Quart. Prog. Rept. No. 49 [Research on Certain Biological Medical Aspects of Atomic Energy] 15 Oct. 1963 p 45–56 refs (See N64-13501 05-16)

Studies carried out to determine the effects on mice of cyanide and related nitriles alone and in combination, when given after lethal whole-body X-ray exposure, are summarized. It is concluded that postirradiation administration of cyanide, potassium sulfite plus cyanide, sodium azide, cysteine hydantoin, and 2-imino-thiazolidene-4-carboxylic acid significantly increased the survival time of female CF_1 mice exposed to lethal doses of whole-body X-ray. P.V.E.

N64-13506 Chicago U., Ill. USAF Radiation Lab.
HISTOPATHOLOGICAL FINDINGS IN THE TISSUES OF MICE PROTECTED AGAINST THE LETHAL EFFECTS OF WHOLE-BODY X-RAY EXPOSURE BY THE POST-IRRADIATION ADMINISTRATION OF SODIUM SULFITE OR A THIAZOLIDINE DERIVATIVE
D. Vesselinovitch, J. Dilley, J. Meskauskas, F. Fitch, and J. Doull *In its* Quart. Prog. Rept., No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 57–69 refs (See N64-13501 05-16)

Discussion is presented of research concerning gross and microscopic changes in the tissues of CF_1 mice given therapeutic dosage levels of 2-imino-thiazolidine-4-carboxylic acid or sodium sulfite, 30 minutes after exposure to various doses of whole-body X-irradiation. Sulfite and, to a lesser extent, 2-imino-thiazolidine-4-carboxylic acid reduced the radiation-induced changes in body weight and in the spleen of mice given 600 r or 700 r of whole-body X-irradiation. Recovery of the hematopoietic system was enhanced in X-rayed mice treated with sodium sulfite or 2-imino-thiazolidine-4-carboxylic acid 30 minutes after radiation exposure (both the myeloblastic and erythroblastic series appeared to be stimulated in the treated irradiated animals but the myeloblastic series appear to recover earlier). Bone marrow hypocellularity was less pronounced in the X-rayed mice that were treated with sodium sulfite and the appearance of gelatinous marrow was less frequent in these animals. Repopulation of the bone marrow in the X-rayed mice treated with sodium sulfite or 2-imino-thiazolidine-4-carboxylic acid was stimulated. P.V.E.

N64-13507 Chicago U., Ill. USAF Radiation Lab.
THE INFLUENCE OF VARIOUS CHEMICAL COMPOUNDS ON RADIATION LETHALITY IN MICE
V. Plzak, M. Root, and J. Doull *In its* Quart. Prog. Rept. No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 70–91 refs (See N64-13501 05-16)

An investigation of the survival time and mortality of male CF_1 mice treated with various chemical compounds immediately prior to the administration of a lethal dose of whole-body X-irradiation is discussed. Of 54 compounds evaluated, 13 were significantly protective in that they permitted 10% more of the animals to survive for 30 days after an otherwise lethal dose (750 r) of whole-body irradiation. Six derivatives gave 20% 30-day survival: 2-(3-hydroxypropyl)-2-thiopseudourea, monohydrobromide, 1,4-dihydro-1-(o-mercaptophenyl)-4,4,6-trimethyl-2-pyrimidinethiol, 6-amino-3-pyridazinethiol, 2-amino-5-(p-aminophenyl-mercapto)-1,3,4-thiadiazole, 5-anilino-1,3,4-thiadiazole-2-thiol, and 5-benzylidene-3-pyridazinethiol 5-benzylidene-3-benzylideneamino-rhodanine. P.V.E.

N64-13508 Chicago U., Ill. USAF Radiation Lab.
EFFECTS OF PARTIAL BODY SHIELDING ON THE ACETYLATION OF SULFANILAMIDE IN CHRONICALLY IRRADIATED MICE
A. Sandberg and J. Doull *In its* Quart. Prog. Rept. No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 92–103 refs (See N64-13501 05-16)

The effect of chronic irradiation on the ability of CF_1 female mice to acetylate sulfanilamide was investigated while the animals received 50 r per day, 100 r per day, and 200 r per day of whole-body X-irradiation, irradiation of the liver area only, or irradiation when the liver area was shielded. The acetylating capacity of the liver was not destroyed when a total of 1,400 r had been accumulated in the groups of mice receiving 200 r per day. After an accumulated dose of 1,300 r in the groups receiving 100 r per day, acetylation of sulfanilamide remained unchanged. There was no impairment of acetylating ability in mice receiving 1,100 r, given in daily doses of 50 r, even though those animals which were given whole-body irradiation were in a moribund condition. Author

N64-13509 Chicago U., Ill. USAF Radiation Lab.
CAGING AND HOUSING EFFECTS ON MORTALITY IN X-RAYED MICE
D. G. Oldfield, V. Plzak, E. L. Simmons, and J. Doull *In its* Quart. Prog. Rept. No. 49 [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 104–114 refs (See N64-13501 05-16)

An investigation into the time course of mortality in groups of mice given a single dose of X-rays and housed, after irradiation, in different but comparable animal quarters, is discussed. The animals were caged, with four in a plastic cage or eight in a metal cage. The investigation indicated that X-rayed animals caged four per plastic cage show an ST_{50} (median survival time) which is 5% to 30% longer than animals caged eight per metal cage; however, the 30-day mortality rate was nearly the same in all groups. P.V.E.

N64-13510 Chicago U., Ill. USAF Radiation Lab.
THE ANALYSIS OF RADIOPROTECTIVE EFFECTS IN PROTON- OR X-RAY-IRRADIATED MICE PRE-TREATED WITH CHEMICAL PROTECTORS
D. G. Oldfield, V. Plzak, and J. Doull *In its* Quart. Prog. Rept. No. 49, [Research on Certain Biological and Medical Aspects of Atomic Energy] 15 Oct. 1963 p 115–123 refs (See N64-13501 05-16)

An initial analysis is discussed of maximum likelihood estimates of 30-day mean lethal dose and other parameters calculated, using a computer, for mice total-body irradiated by high-energy (440 Mev) protons or by median energy (250 kvp) X-rays with and without preirradiation treatment with 2-mercaptoethylamine hydrochloride (MEA) or p-aminopropiophenone (PAPP). Based on DRF's (dose-reduction factors) and the specific drug dosage levels used, MEA is a better protector than PAPP against high-energy proton irradiation, but a poorer protector than PAPP against medium-energy X-ray irradiation. P.V.E.

N64-13575 Joint Publications Research Service, Washington, D.C.
DESIGN OF ISOPLANETIC SYSTEMS
A. P. Dmitriyev *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 115–124 refs (See N64-13565 05-01) OTS: $3.00

Equations are presented to facilitate the design of isoplanetic systems from surfaces which are aplanetic and concentric to the pupil of the eye. Methods of calculating are given that require the use of logarithmic tables. Author

N64-13582 Joint Publications Research Service, Washington, D.C.
SOVIET RESEARCH ON FACTORS AFFECTING MAN'S VISUAL AND AUDITORY ANALYZERS
A. O. Navakatikyan et al 14 Jan. 1964 23 p refs Transl. into ENGLISH of two articles from Fiziol. Zh. SSSR (Moscow), v. 49, no. 9, Sep. 1963
(JPRS-22735; OTS-64-21292) OTS: $0.75

CONTENTS:

1. ANALYSIS OF THE EFFECT OF PHYSICAL STRAIN, HIGH ENVIRONMENTAL TEMPERATURE AND HIGH OXYGEN CONTENT IN INSPIRED AIR ON THE EXCITABILITY OF THE VISUAL ANALYZER IN MAN A. O. Navakatikyan, V. V. Lebedeva, I. N. Blagoveshchenskaya, and S. A. Pevnyy p 1–11 refs (See N64-13583 05-16)
2. ADEQUATOMETRIC INVESTIGATION OF THE VISUAL AND AUDITORY ANALYZERS OF MAN IN THE PROCESS OF ADAPTATION TO CLIMATIC CONDITIONS B. A. Funtikov p 12–20 refs (See N64-13584 05-16)

N64-13583 Joint Publications Research Service, Washington, D.C.
ANALYSIS OF THE EFFECT OF PHYSICAL STRAIN, HIGH ENVIRONMENTAL TEMPERATURE AND HIGH OXYGEN CONTENT IN INSPIRED AIR ON THE EXCITABILITY OF THE VISUAL ANALYZER IN MAN
A. O. Navakatikyan, V. V. Lebedeva, I. N. Blagoveshchenskaya, and S. A. Pevnyy *In its* Sov. Res. on Factors Affecting Man's Visual and Auditory Analyzers 14 Jan. 1964 p 1–11 refs (See N64-13582 05-16) OTS: $0.75

The environmental conditions to which man is subjected when attempting a mining rescue were simulated, and the effect of these conditions on man was investigated. Results indicated that a high environmental temperature, physical strain, and an increased oxygen concentration in the inhaled air significantly influence the excitability of the visual mechanism. The hour-long effect of high temperature, physical strain, and oxygen content resulted in an increase of the minimum amount of stimulus energy necessary to the production of a response. R.T.K.

N64-13584 Joint Publications Research Service, Washington, D.C.
ADEQUATOMETRIC INVESTIGATION OF THE VISUAL AND AUDITORY ANALYZERS OF MAN IN THE PROCESS OF ADAPTATION TO CLIMATIC CONDITIONS
B. A. Funtikov *In its* Sov. Res. on Factors Affecting Man's Visual and Auditory Analyzers 14 Jan. 1964 p 12–20 refs (See N64-13582 05-16) OTS: $0.75

The effect of climatic factors on the excitability of the visual and auditory organs of man was investigated. A study was undertaken in order to determine adequate optical and auditory stimuli under these conditions. Results indicated that, in comparison with the excitability in the temperate zone, there is a regular lowering of the excitability of the visual and auditory organs of man in the tropics and an increase in their excitability in the Arctic. R.T.K.

N64-13615 National Academy of Sciences–National Research Council, Washington, D.C. Committee on Hearing, Bioacoustics, and Biomechanics
CRITICAL EVALUATION OF METHODS OF TESTING AND MEASUREMENT OF NONORGANIC HEARING IMPAIRMENT Report of Working Group 36
Bernard Anderman, Jozef J. Zwislocki, Hallowell Davis, Leo Doerfler, Meyer Fox et al Nov. 1963 26 p refs
(Contract Nonr 2300(05))
(AD-425085)

Nonorganic hearing impairments include all of the classes of abnormal auditory function for which no plausible anatomical or physiological basis can be found or inferred. The basis for such impairments is presumably in the more complex activities of the central nervous system, which are better understood in psychological terms such as lack of cooperation, neurotic behavior, or deliberate deceit. A nonorganic impairment is usually presumed to have existed when auditory performance improves significantly on a subsequent test without any known change in the auditory system. The improvement must, however, be greater than the range of variation to be expected for the particular test. Nonorganic hearing impairment often appears as an "overlay" combined with a definite organic hearing loss. Some of the best tests are limited to the detection of monaural nonorganic impairments. Some other tests lose effectiveness when the subject has learned their principles. Routine audiometry can and should include a few simple indicator tests such as consistency of thresholds on repeated trials or agreement of the speech reception threshold with the prediction from the pure tone audiogram. Author

N64-13629 Bryn Mawr Coll., Pa.
EFFECT OF EXPOSURE TO LOW TEMPERATURE ON BLOOD CLEARANCE OF CARBON AND BACTERIA IN MICE
L. J. Berry Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jul. 1963 15 p refs
(Contract AF 41(657)-340)
(AAL-TDR-63-1; AD-427166)

Mice housed at 5° C clear carbon from the blood more slowly than animals at 25° C, but those in the cold clear at the same rate even after exposures of 2, 18 or 72 hr prior to the test. Bacteria are also cleared uniformly at the two temperatures when a highly virulent strain of *Salmonella typhimurium* is injected intravenously, but not when one of low virulence is used. Mice at 25° C show a steady decline in bacteremic level, but not those at 5° C. The LD_{50} dose of bacteria via the intravenous route is higher than the intraperitoneal dose, with strains of each virulence in mice kept at 25° C, but it is clearly lower for the mice housed at 5° C. In line with these findings is the observation that exposure to 5° C for 8 hr post infection followed by 16 hours at 25° C yields mortalities similar to continuous exposure to 25° C and vice versa. Author

N64-13630 Harvard U., Boston, Mass. Medical School
EFFECT OF LOW TEMPERATURE ON THE ISOLATED HEARTS OF *CITELLUS LEUCURUS* AND *C. MOHAVENSIS*
C. P. Lyman Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Sep. 1963 8 p refs
(Contract AF 41(657)-380)
(AAL-TDR-63-4; AD-427054)

The perfused, isolated hearts of two desert-living ground squirrels, *Citellus mohavensis* and *C. leucurus*, were exposed to temperatures between 25° and 0° C. Although *C. mohavensis* hibernates and aestivates and *C. leucurus* does neither, the temperature-rate curves were very similar, and typical of hibernators in general. *C. leucurus* is highly adapted to a diurnal existence in hot arid regions and has a high critical and lethal temperature, yet its heart has not changed its ability to tolerate low temperatures. Author

N64-13631 Washington, U., Seattle
CELL PROLIFERATION IN THE ADRENAL OF CONTROL AND COLD EXPOSED RATS
N. V. Everett and Shirley J. Weber Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Aug. 1963 11 p refs
(Contract AF 41(657)-309)
(AAL-TDR-63-7; AD-427040)

Tritiated thymidine coupled with high-resolution radioautography was employed to assess new cell formation in the adrenal of control rats and of animals after different periods of cold exposure. Evidence is presented for new cell formation in each of the three cortical zones of controls and of experimental rats during all periods of cold exposure. Cold exposure effected an increase in new cell formation within the glomerular and fasciculate zones but not in the reticular zone. The results support the concept of functional independence of the three cortical zones. A small percentage of the chromaffin cells of the adrenal medulla was labeled in both control and experimental animals, indicating a slow rate of renewal that seemed not to be changed by cold exposure. Author

N64-13632 Aerospace Medical Div., Arctic Aeromedical Labs., Fort Wainwright, Alaska
METABOLIC STUDIES OF AN AMINO ACID IMBALANCE IN COLD EXPOSED RATS
G. J. Klain and R. L. Winders Aug. 1963 14 p refs
(AAL-TDR-63-33; AD-427201)

Young rats fed an amino acid-imbalanced diet based on 6% fibrin, and supplemented with 0.4% DL-methionine and 0.6% DL-phenylalanine had increased activities of liver arginine synthetase and arginase, and increased plasma levels of a number of amino acids. However, the activities and levels of these metabolites were decreased in a comparable group of animals exposed to 7° C. The activity of the expired CO_2, originating from intraperitoneally administered 2 μc each of carbon-labeled methionine, phenylalanine or alanine, indicated that the rats kept at room temperature could not effectively oxidize the two imbalancing amino acids to maintain a proper balance in the amino-acid pool for the protein synthesis. In contrast, the cold-exposed animals were able to catabolize the excessive levels of methionine and phenylalanine and utilize them for energy purposes. The remaining balanced portion of the amino acid pool was then apparently used for the formation of new tissues, as also indicated by greater gains in body weight. Author

N64-13633 Aerospace Medical Div., Arctic Aeromedical Labs., Fort Wainwright, Alaska
RECTAL TEMPERATURE OF THE WORKING SLED DOG
C. J. Eagan, J. L. Durrer, and W. M. Millard Oct. 1963 11 p refs
(AAL-TDR-63-40; AD-427041)

Rectal temperatures were measured on Husky sled dogs doing hard work (sled pulling) at ambient temperatures of 0° C and lower. Even in efforts that seemed maximal, rectal temperature usually increased no more than 1° C above the mean resting temperature range of 38.5° to 38.9° C. In exceptional cases it increased as much as 2° C. The mean rectal temperature measured on 17 dogs at the end of a 30-mile (48.3 km) championship race was 39.7° C. It is concluded that

the dissipation of body heat produced during heavy work in the cold imposes no physiological strain on the Husky sled dog. Author

N64-13645 John B. Pierce Foundation of Connecticut, New Haven
THERMAL AND METABOLIC RESPONSE OF THE KALAHARI BUSHMEN TO MODERATE COLD EXPOSURE AT NIGHT
H. T. Hammel, J. A. Hildes, D. C. Jackson, and H. T. Andersen Sep. 1963 32 p refs
(Contract AF 41(657)-415)
(AAL-TDR-62-44; AD-427039)

Studies were made of 10 adult male Bushmen and 4 Europeans during night-long exposure to ambient temperatures of approximately 6° C using only single-blanket sleeping bags. Rectal temperature of both groups started at about 36.8° C, but in the Bushmen fell 0.7° C lower than in the Europeans during the cold night. Calculated mean body temperature also fell lower in the Bushmen. Mean skin temperature of the Bushmen started higher but was the same as that of the Europeans at the end of the night, although the foot temperatures of the Bushmen were lower. The heat production of both groups was the same at the start, expressed as kcal per kg lean body mass per hour (approximately 1.5). Both rose during the cold night but the Bushmen increase was only half as great as that of the Europeans. Shivering in the Bushmen was less than in the Europeans and sleep was interrupted less in the Bushmen. Author

N64-13653 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
ATTENUATION OF NONUNIFORM SUIT TEMPERATURES FOR SPACE SUITS IN ORBIT
Kenneth R. Cramer and Thomas F. Irwine, Jr. (State U. of N.Y.) Sep. 1963 15 p refs
(AMRL-TDR-63-80; AD-425812) OTS: $0.50

A cylindrical model of a water-jacket space suit exposed to solar and metabolic heating was examined to determine the waterflow rates required to reduce large equilibrium suit-temperature differences. Analytical results demonstrate that variations in the metabolic heating rate are unimportant, and only moderate waterflow rates are required to reduce the maximum suit temperature difference to a few degrees Fahrenheit. Author

N64-13661 Harvard U., Boston, Mass. Medical School
HIBERNATION IN MAMMALS AND BIRDS
C. P. Lyman Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Aug. 1963 16 p refs
(Contract AF 41(657)-380)
(AAL-TDR-63-3; AD-427053)

Hibernation in mammals and birds, from its initiation through the long dormancy to the violent arousal, is a controlled process, developed through evolution to permit the animal to escape from an unfavorable environment. The same type of hibernation, using the same basic physiological modification, occurs in mammals which are so remotely related phylogenetically, that one must conclude that hibernation developed separately in several groups as the environmental stress arose. It is not a primitive return to the cold-blooded state, indicating a vestigial reptilian type of temperature control, but rather a specialized temperature regulation with precise control of its own. Author

N64-13662 Bryn Mawr Coll., Pa.
THE IMPLICATION OF TRYPTOPHAN PYRROLASE IN ENDOTOXIN POISONING
L. J. Berry Ft. Wainwright, Alaska, Sep. 1963 24 p refs
(Contract AF 41(609)-1764)
(AAL-TDR-63-13; AD-427167)

An attempt has been made to relate the protective effect of cortisone against lethality of bacterial endotoxins in mice to changes in activity of liver tryptophan pyrrolase (TP), an enzyme known to be activated by the hormone. In mice maintained at 25° C, TP activity remained normal under conditions associated with survival and diminished in activity when animals were not protected. In addition, nicotinamide and diphosphopyridine nucleotide (DPN) were found to protect mice at 25° C against lethality of endotoxin about as effectively as cortisone. At 5° C, however, mice could not be protected against death from endotoxin by DPN, and even cortisone and nicotinamide were less effective than at 25° C. Mice in the cold die sooner than, and with different symptoms from, those at room temperature. Author

N64-13692 Joint Publications Research Service, Washington, D.C.
STUDIES IN REACTION OF CELLS TO THE EFFECTS OF EXTREME CONDITIONS
6 Jan. 1964 54 p refs Transl. into ENGLISH of 4 articles from the publ. "Reaktsiya Kletok na Ekstremal'nyye Vozdeystviya", Moscow, Acad. of Sci. USSR, 1963 p 6–13, 114–124, and 126–133
(JPRS-22613; OTS-64-21215) OTS: $1.50

CONTENTS:

1. EFFECT OF CRYOLYSIS AND ULTRASONIC VIBRATIONS ON ACTOMYOSIN M. A. Khenokh, G. P. Pinayev, and Ye. A. Kovalova p 1–11 refs (See N64-13693 05-16)
2. CHANGE IN THE DESOXYRIBONUCLEASE ACTIVITY DURING X-RAY IRRADIATION K. I. Pravdina p 12–28 refs (See N64-13694 05-16)
3. ON THE MECHANISM OF CYSTEAMINE PROTECTIVE ACTION E. A. Val'dshteyn p 29–39 refs (See N64-13695 05-16)
4. RADIORESISTANCE OF THERMOTOLERANT STRAINS OF *ESCHERICHIA COLI* V. D. Zhestyanikov p 40–51 refs (See N64-13696 05-16)

N64-13693 Joint Publications Research Service, Washington, D.C.
EFFECT OF CRYOLYSIS AND ULTRASONIC VIBRATIONS ON ACTOMYOSIN
M. A. Khenokh, G. P. Pinayev, and Ye. A. Kovalova *In its* Studies in Reaction of Cells to the Effects of Extreme Conditions 6 Jan. 1964 p 1–11 refs (See N64-13692 05-16) OTS: $1.50

This paper shows that the aggregation of macromolecules, reversible alterations of the ATP-ase activity, and changes of the number of SH-groups in actomyosin solutions occur under the influence of extremely low temperatures (78° F). Ultrasonic waves cause a decrease in structural viscosity, catalytic activity, and number of SH-groups. Author

N64-13694 Joint Publications Research Service, Washington, D.C.
CHANGE IN THE DESOXYRIBONUCLEASE ACTIVITY DURING X-RAY IRRADIATION
K. I. Pravdina *In its* Studies in Reaction of Cells to the Effects of Extreme Conditions 6 Jan. 1964 p 12–28 refs (See N64-13692 05-16) OTS: $1.50

The DNA-ase II activity has been studied in the mitochondria and supernatant liquid of the liver and spleen. In the spleen, DNA-ase II was most active. In experiments in vitro and in vivo, X-ray irradiation increased the DNA-ase II activity in the supernatant liquid of the spleen. The anaerobic irradiation of the mitochondria suspension prevented, only slightly, an increase in DNA-ase activity of the supernatant liquid of the spleen. Author

N64-13695 Joint Publications Research Service, Washington, D.C.

ON THE MECHANISM OF CYSTEAMINE PROTECTIVE ACTION

E. A. Val'dshteyn *In its* Studies in Reaction of Cells to the Effects of Extreme Conditions 6 Jan. 1964 p 29–39 refs (See N64-13692 05-16) OTS: $1.50

The protective effect of cysteamine has been studied on two strains of *E. coli* B and B/r. Postirradiation cysteamine protection was observed; irradiation and addition of cysteamine after irradiation took place in strictly anoxic conditions. Cysteamine protects bacteria from: (1) short-lived oxygen-dependent primary injuries, (2) long-lived oxygen-dependent primary injuries, and (3) short-lived oxygen-independent injuries. The effect of oxygen was observed. Author

N64-13696 Joint Publications Research Service, Washington, D.C.

RADIORESISTANCE OF THERMOTOLERANT STRAINS OF *ESCHERICHIA COLI*

V. D. Zhestyanikov *In its* Studies in Reaction of Cells to the Effects of Extreme Conditions 6 Jan. 1964 p 40–51 refs (See N64-13692 05-16) OTS: $1.50

Thermotolerant variants of bacteria which are able to form macrocolonies at 50° F. have been obtained by a prolonged cultivation of *E. coli* B, B/r, and K_{12} on agar with eosine-methylene blue, with gradually increasing temperatures. The radioresistance of thermotolerant strains of *E. coli* B, B/r, and K_{12} does not differ from that of the initial cultures. The exception is a thermotolerant variant of *E. coli* B bred on the simple nutrient agar at 46° F.; the increase in radioresistance of this strain is connected with the formation of elongated forms. The experiments on heat reactivation of thermotolerant *E. coli* B and B/r do not reveal any difference in survival curves obtained with the strains incubated after X-ray irradiation. Author

N64-13714 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

GENERAL PRINCIPLES OF BIOLOGICAL REGENERATION FOR LUNAR BASE LIFE SUPPORT

R. H. Mattoni *In its* Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 101–109 refs (See N64-13701 05-01)

This paper concludes that a biological regeneration system is ideal for a lunar base of extended duration and will be reliable. Primary limitation would be atmospheric leakage, and some power and water reservations. Simple to complete bioregenerative systems are evaluated, and functions of bacteria and algae in a system are explained. A theory is offered of strain-selectivity and stabilization in operation, and a complete bioregenerative system employing chickens is described. Author

N64-13715 Martin-Marietta Corp., Denver, Colo.

ALGAL PHOTOSYNTHETIC GAS EXCHANGERS

Robert D. Gafford *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 111–117 (See N64-13701 05-01)

Closed ecological systems developed to support manned space operations will employ some bioregenerating components. One of the most likely of these is the photosynthetic gas exchanger, which has the potential capability of producing oxygen and consuming carbon dioxide, while simultaneously converting human wastes to useful food. The determination of when and how to employ photosynthetic gas exchangers will depend on the development of prototype systems from which engineering data can be obtained. Preliminary studies indicate that the electrical power required per man for illuminating photosynthetic gas exchangers will be from 3 to 5 kw; that solar-illuminated systems are feasible, and will require approximately 6 m^2 of exposed surface per man under continuous illumination; and that harvested algae can provide part of the food for an astronaut. Author

N64-13716* National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.

ENVIRONMENTAL CONTROL DEVELOPMENT AND LUNAR BASE SUPPORT MODULES

D. M. Perry *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 119–126 (See N64-13701 05-01)

This paper reviews the changing concepts on environmental control systems developed through Mercury missions and Apollo planning and includes approaches necessary to establishing a closed environment. An additional concept is reviewed covering the use of prefabricated modules to be soft-landed on the lunar surface. The modules would have long-term standby capabilities and would provide facilities support for basic survival purposes, through extended stays and permanent lunar and planetary basing. Author

N64-13812 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center

THE INFLUENCE OF ELECTROSLEEP ON THE THERMOREGULATION REFLEX AND ELECTRIC RESISTANCE OF THE SKIN IN PATIENTS WITH PRURITIC DERMATOSIS

L. D. Butovetsky 13 Dec. 1963 10 p refs Transl. into ENGLISH from Vestn. Dermatol. i Venerol. (Moscow), v. 34, 1960 p 19–21
(RSIC-105; AD-426803)

The change in the thermoregulation reflex and the electric resistance of the skin under the influence of electrosleep was studied in 33 patients with various dermatoses. The thermoregulation reflex was found to be disturbed in the majority of patients with eczema. A normalization of the reflex, which coincided with an improvement of the skin process through the influence of electrosleep, was noted in seven patients. The results of the effect of treatment by electrosleep of patients with a disturbed thermoregulation reflex were inconclusive. The electric resistance of the skin was found to be lower in a majority of patients with eczema, even in areas distant from the focal section. Under the influence of electrosleep, the electric resistance did not undergo any essential change. R.T.K.

N64-13827 Texas A and M. U., College Station

INCAPACITATION OF THE GOAT FOLLOWING MASSIVE DOSES OF MIXED NEUTRON AND GAMMA RADIATION

Earl Rudder, Wayne C. Hall, and Sidney O. Brown Kirtland AFB, N. Mex., AF Weapons Lab., Dec. 1963 234 p refs
(Contract AF 29(601)-5211)
(RTD-TDR-63-3077; AD-426777)

Hematological, physiological, and psychological response data resulting from massive doses of mixed gamma and neutron irradiation are presented. Four exposure series are described

involving 120 Spanish goats, 8 Angora goats, and 8 sheep. Doses and dose rates range from 158 rads to 50,694 rads at rates of 316 to 633 rads per minute. The doses are recorded as midline air doses. A review of the open literature relating to incapacitation doses is furnished that describes in detail the physical features under which exposures have been carried out. Author

N64-13830 Johns Hopkins U., Baltimore, Md.
THE EFFECT OF COLD ON SOME ASPECTS OF PROTEIN METABOLISM
Bacon F. Chow Fort Wainwright, Alaska Arctic Aeromedical Lab., Aug., 1963 10 p
(Contract AF 41(657)-299)
(TN-62-11; AD-427202)

The effect of cold on some aspects of protein metabolism in rats was investigated. Results include: (1) The urinary excretion of rats on a protein-free diet increased when the animals were placed at temperatures of 2° ± 2° C and 25° ± 3° C and also increased to some extent at 37° C. The catabolic process of the animals' own tissue, at the decreased environmental temperature, proceeded with a mechanism independent of any increased caloric requirement. (2) An increase in caloric intake on an isoproteinic diet significantly reduced proteinuria at 4° C. Paper electrophoretic analyses of the protein in the urine indicated that this protein was distinct from albumin in rat serum, having a mobility about 25% larger than that of albumin. (3) The increase in urinary nitrogen excretion following exposure at 2° C was mediated through a mechanism different from that induced by an administration of cortisone. (4) The nitrogen balance indices of lactalbumin, casein, and soybean protein in animals exposed to 4° C indicate that the nutritive values of protein were dependent on the temperature of the environment under which the test was carried out, and that the nitrogen indices were reduced upon lowering of the temperature from 25° C. I.v.L.

N64-13831 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
THE EFFECT OF POSITIVE PRESSURE BREATHING ON ARTERIAL OXYGEN SATURATION AND PULMONARY VENTILATION IN SUBJECTS EXPOSED TO HIGH TRANSVERSE ACCELERATION
John H. Reed, Jr., B. F. Burgess, Jr., and Harold Sandler 15 Nov. 1963 26 p 13 refs
(NADC-MA-6323; AD-424922)

Twenty-two centrifuge runs were performed on eight subjects in whom arterial oxygen saturation was continually monitored with a Waters cuvette while the subjects were exposed to various transverse accelerations $+G_x$ at a seat angle of 6° head up. Conditions for breathing during the runs were: air (control), air positive pressure, pure oxygen (control), and pure oxygen positive pressure. The positive pressure was metered automatically to provide 3 mm Hg per g above ambient pressure. The results show that the slope of the oxygen saturation curve plotted against time for air and air positive pressure decreased approximately 3 percent every 10 seconds, beginning 10 to 20 seconds after the onset of the acceleration. During the oxygen breathing studies, a lowering in arterial oxygen saturation was observed approximately 100 seconds after the onset of acceleration. A method is suggested for estimating physiological limits for theoretical profiles of acceleration G plotted against time. Author

N64-13852 Boeing Co., Seattle, Wash.
HESTIANIC ACID—A BIOLOGICALLY RESISTANT PIGMENT FROM AEROBIC WASTE DIGESTERS
Carl Emanuel Brooks AFB, Tex., School of Aerospace Med., Oct. 1963 15 p refs
(Contract AF 41(657)-387)
(SAM-TDR-63-57; AD-425940)

The isolation and chemical properties of a brown copper-containing pigment which arises from aerobic, biologic degradation of human waste are described. This pigment, called hestianic acid, was shown to possess a formidable structural complexity and heterogeneity. It was also notable for its chemical and biologic inertness and, therefore, represented the main bulk of the residual organic material in the well-digested, activated sludge-process effluent. The present evidence indicates, but does not prove, that hestianic acid derives from the ubiquitous melanine pigments in natural food stuffs. The pigment also possesses several properties in common with the humic acids and would, under less artificial conditions, be incorporated into the humic acids of the soil. Author

N64-13854 Ohio State U., Columbus
THE EFFECTS OF PSYCHOMOTOR AROUSAL, HEMORRHAGE, AND THE UPRIGHT POSTURE ON THE CIRCULATION OF THE YOUNG CHIMPANZEE
Arnold M. Weissler, Clyde D. Schoenfeld, Vernon L. Carter, Sidney Cohen, and Alden E. Stilson, Jr. et al Holloman AFB, N. Mex., 6571st Aeromed. Res. Lab., Dec. 1963 30 p refs
(Contract AF 29(600)-3468)
(ARL-TDR-63-28; AD-296941)

In the present study employing standard techniques of cardiac catheterization and the indicator dilution method for cardiac output, baseline hemodynamic observations were made in the young chimpanzee. Determinations of pressure in the pulmonary and systematic circulation and cardiac output were obtained with the animals at rest in the supine position and during the altered hemodynamic states accompanying psychomotor arousal, hemorrhage, and head-up tilt. All studies were performed without pharmacologic preparation of the animals. Comparison of the circulation of the chimpanzee with that in the human demonstrated a tendency for heart rate, cardiac output, and arterial pressure to be higher, whereas pressures in the pulmonary circulation were in a range similar to that in the human of comparable size and age. These observations demonstrate that the chimpanzee is a convenient laboratory primate for hemodynamic studies in whom circulatory responses can be observed with techniques commonly employed in the human. Author

N64-13865 School of Aerospace Medicine, Brooks AFB, Tex.
MICROORGANISMS IN HUMAN GINGIVAL TISSUES
William A. Gibson and Ira L. Shannon Oct. 1963 7 p refs
(SAM-TDR-63-88; AD-425477)

Gingival strip biopsies were taken from areas of obvious inflammation in 191 systemically healthy young adult males. For 72 of these subjects, a thorough oral prophylaxis was performed 24 hours prior to experimental participation. The remaining 119 subjects received no dental treatment of any type and served as controls. Serial sections were stained by four different methods: hematoxylin-eosin, the Brown and Brenn modification of the Gram stain, the Grocott modification of the Gomori's methenamine-silver nitrate technic, and a combined Gram and Twort's staining technic. Bacteria were found in the gingival tissues of approximately 10% of the non-treated subjects and 60% of those who received oral prophylaxis. These findings were held to be inconsistent with the premise of active bacterial invasion in gingival inflammation. Author

N64-13869 Chicago U., Ill.
FROG LABYRINTHINE EFFERENT IMPULSES
R. S. Schmidt Brooks AFB, Tex., School of Aerospace Med., Sep. 1963 15 p refs
(Contract AF 41(609)-1479)
(SAM-TDR-63-66; AD-425564)

Efferent impulses were recorded from the free ends of nerves detached from the ampullae, sacculus, utriculus, and lagena in the leopard frog (*Rana pipiens*). These impulses were found to be initiated by stimulation of any ampulla or a variety of unidentified extralabyrinthine proprioceptors. None were evoked in response to stimulation of the auditory or otolith organs. There was no spontaneous resting activity in the efferent fibers. Author

N64-13931 School of Aerospace Medicine, Brooks AFB, Tex.
URINARY CATECHOLAMINES IN MOTION SICKNESS AND TURBULENT FLIGHT
Joseph L. Borowitz, Elmer J. Schultz, and William W. Lackey Nov. 1963 8 p refs
(SAM-TDR-63-9; AD-426121)

Urine samples were collected from 65 young airmen, both before and after they were subjected to turbulent motion in C-47 aircraft. Similar samples were collected from 31 young airmen who were taken on flights during which no turbulence was voluntarily induced. The acidified but unboiled urines were analyzed for "free" catecholamines. Neither norepinephrine nor epinephrine output in urine was related to vomiting or sweating during the turbulent flights. The output of norepinephrine and epinephrine was significantly greater during turbulent flights than during flights in which no turbulence was induced. Urinary epinephrine output was also significantly increased during the turbulent flights as opposed to the preflight period. Changes in urinary catecholamine output during flying are therefore associated with tubulence, but appear to be distinct from the motion-sickness syndrome. Author

N64-13968 Magna Corp., Anaheim, Calif. Research and Development Div.
BIOCHEMICAL FUEL CELLS Fifth Quarterly Progress Report, 1 Jul.-30 Sep. 1963
J. M. Brake, W. R. Momyer, and H. P. Silverman [1963] 38 p refs
(Contract DA-36-039-SC-90866)
(AD-426937)

The electro-oxidation of hydrogen and formic acid was investigated under conditions compatible with, but independent of, biological systems. The best performance was obtained with formic acid. This electrode supported 10 ma/cm^2 at a polarization of 260 mv under conditions compatible with *E. coli*. Improved and more consistent growth of *Cl. butyricum* was obtained with AC broth supplemented with thioglycollate. Hydrogen production as a function of growth, as well as the best time to harvest cells for optimum hydrogen production, was also determined. The electrochemical behavior of *E. coli*-glucose and *Cl. butyricum*-glucose systems, two potentially useful bioelectrodes, was investigated using dispersed suspensions of the bacteria. The limiting current density and the rate of hydrogen production were determined as a function of bacterial concentration. Preliminary indications are that higher current densities are possible with the integrated *E. coli*-glucose system, in which the electrochemical and biological reactions are combined, than can be obtained by simply oxidizing the hydrogen from the biological fermentation of glucose by this organism. Author

N64-13988 New Hampshire U., Durham
RELATIONSHIP OF COLD UPON THE BIOLOGICAL PROPERTIES PECULIAR TO INFLUENZA VIRUS AND ITS CAPACITY FOR INVASIVENESS AND MULTIPLICATION
T. G. Metcalf Fort Wainwright, Alaska, Arctic Aeromed. Lab., Aug. 1963 7 p
(Contract AF 41(657)-350)
(TN 62-12; AD-427169)

Alaskan ground squirrels have been examined for their excretion of animal and bacterial viruses. Eighty-one separate fecal samples from 25 animals yielded negative findings for bacterial viruses reactive against five strains of *Escherichia coli*. Sixty-six individual fecal samples from 24 animals failed to show the presence of animal viruses capable of causing cytopathogenic effects in HeLa, Human Amnion, and the $LLMK_2$ strain of monkey kidney monolayers. Neuraminidase activity of influenza virus was demonstrated at 25° C. The amount of neuraminic acid split from the substrate by enzyme action at 25° C was less than that observed at 37° C. Ovomucin obtained from fresh hens' eggs was prepared and shown capable of serving as a suitable substrate for influenza neuraminidase. Author

N64-14044 Worcester Foundation for Experimental Biology, Shrewsbury, Mass.
BIOCHEMICAL RESPONSE OF IMMATURE CHIMPANZEES TO SEVERE ENVIRONMENTAL STRESS
D. S. Layne, F. Elmadjian, G. Pincus, and T. L. Gleason III Holloman AFB, N. Mex., 6571st Aeromed. Res. Lab., Nov. 1963 81 p refs
(Contract AF 29(600)-3336)
(ARL-TDR-63-26; AD-425859)

Further information on the response of chimpanzees to severe environmental stress by biochemical examination of urine and plasma samples was obtained. The effects of various conditions of temperature and humidity were studied. Tests were conducted in a centrifuge simulating the conditions present during launch acceleration and reentry deceleration of orbital flight, and one experiment was carried out involving an actual orbital flight. In addition, a test was conducted simulating the environmental conditions of orbital flight using an advanced biomedical capsule. Plasma samples were collected from animals subjected to a temporal delay task which involved pacing behavior. A discussion of results and conclusions is included. J.E.T.

N64-14046 Sandia Corp., Albuquerque, N. Mex.
HEALTH PHYSICS ASPECTS OF OPERATION ROLLER COASTER
William D. Burnett, Harold L. Rarrick, and George E. Tucker, Jr. Jan. 1964 35 p refs
(SC-4973(RR)) OTS: $0.75

Discussed are the radiological safety problems related to the joint AEC-DOD-UK research program, Roller Coaster, for the evaluation of the storage, handling, and transportation criteria of plutonium-bearing weapons and to the post-test cleanup. The program included four experimental detonations: Double Tracks, in which the biological hazard of scattered plutonium was investigated and Clean Slates One, Two, and Three, in which the scavenging effect of earth covering of storage structures was evaluated. Author

N64-14074 Joint Publications Research Service, Washington, D.C.
SOME DATA ON THE USE OF MUSCLE RELAXANTS
V. Ye. Orlov 30 Jan. 1964 6 p Transl. into ENGLISH from Eksperim. Khirur. i Anesteziol (USSR), no. 6, 1963 p 66-67
(JPRS-22995; OTS-64-21439) OTS: $0.50

Results of an analysis of 1,271 operations in which muscle relaxants were used indicate the following: (1) Spirography and oxyhemography should always be used to control restoration of adequate pulmonary ventilation after the repeated administration of muscle relaxants. (2) Intravenous administration of calcium chloride solution leads to an increase in pulmonary ventilation which is usually transient. R.T.K.

N64-14133 Joint Publications Research Service, Washington, D.C.

CHANGES OF THE MORPHOLOGICAL AND FUNCTIONAL PROPERTIES OF THE BLOOD AND HEMODYNAMICS DURING WORKING WITH EXTRACORPOREAL CIRCULATION APPARATUS OF NIIEKhA AND I (AIK-59) AND BALYUZEK (ISL-2) SYSTEMS

V. I. Kolesov et al 27 Jan. 1964 11 p refs Transl. into ENGLISH of an article from Grudnaya Khirurgiya (Moscow), v. 5, no. 6, 1963 p 34–39

(JPRS-22914; OTS-64-21397) OTS: $0.50

In experimental and clinical investigations during perfusion and in the postoperative period, the authors assessed changes of the morphological (leukocyte count, leukocyte formula, red blood, hemolysis) and functional properties of the blood, in particular its enzymatic systems (the content of peroxidase in granulocytes, osmotic resistance of leukocytes, activity of the respiratory enzyme–carbonic anhydrase in erythrocytes). Also under study were alterations of the blood coagulation system and hemodynamic shifts occurring during the use of apparatus of extracorporeal circulation. Author

N64-14134 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF G-FORCE ON THE STRUCTURE OF THE VASCULAR SYSTEM

M. G. Prives 28 Jan. 1964 17 p refs Transl. into ENGLISH of an article from Arkh. Anat., Gistol. i Embriol. (Moscow), v. 45, no. 11, Nov. 1963 p 3–13

(JPRS-22956; OTS-64-21420) OTS: $0.50

The effect of g-force on the structure of the vascular system of rabbits and albino rats was investigated. Results indicate that: (1) The effect of considerable g-force, causing the animals' death, produces morphological changes in the vascular system as expressed by dilatation of the vessels, increase in the number of visible vessels, especially of the fine ones, with increase in their diameter, appearance of tortuosity, and change in angioarchitectonics. Muscle sheath atrophy and elastic structure dystrophy are observed in the arterial walls. These changes, under the effect of head–pelvis g-force, are more pronounced in the hind extremity than in the front one. With pelvis–head g-force, they are more pronounced in the anterior extremities. (2) The described changes are functional inasmuch as they disappear a certain time after termination of exposure to g-force. However, even one year later some changes remain in the arterial wall that are indicative of relatively severe changes of vascular structure, especially of the tunica elastica. I.v.L.

N64-14142 Joint Publications Research Service, Washington, D.C.

CYBERNETICS IN THE SCIENCES, ENGINEERING AND ECONOMY OF THE GERMAN DEMOCRATIC REPUBLIC

Hermann Klare et al 28 Jan. 1964 203 p refs Transl. into ENGLISH of the publ. "Uber Wissenschaftliche Grundlagen der Modernen Technik: Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR", E. Berlin, 1963 p 1–186 Presented at the Conf. of the Comm. for Cybernetics, E. Berlin, 16–17 Oct. 1962

(JPRS-22931; OTS-64-21406) OTS: $3.50

CONTENTS:

1. PHILOSOPHY AND CYBERNETICS G. Klaus (Ger. Acad. of Sci., E. Berlin) p 6–22

2. MATHEMATICS AND CYBERNETICS W. Kammerer (Ger. Acad. of Sci., E. Berlin) p 23–40 refs

3. ON THE MOST RECENT DISCUSSIONS ON PHILOSOPHICAL PROBLEMS IN CYBERNETICS A. Kolman (Czech. Acad. of Sci.) p 41–48 refs

4. ON THE THEORETICAL CRITERION ON "ANTICYBERNETICISM" L. Kalmar (Hung. Acad. of Sci.) p 49–52

5. THE CONCEPTS OF INFORMATION AND QUALITY R. Thiel (Humboldt U., E. Berlin) p 53–58 refs

6. SCIENCES AND CYBERNETICS J. Behr (Ger. Acad. of Sci., E. Berlin) p 59–80 refs

7. CYBERNETICS AND THE PLANNING OF THE PEOPLES' ECONOMY J. Rudolph (Berlin-Karlshorst Coll. of Econ.) p 81–85 refs

8. AN INTRODUCTION OF MATHEMATICAL AND CYBERNETIC METHODS INTO ECONOMICS G. Wintgen (Humboldt U., E. Berlin) p 86–87

9. SOME PROBLEMS OF THE APPLICATION OF CYBERNETIC METHODS IN THE ECONOMIC SCIENCES H. Luck (Rostock U.) p 88–91

10. THE PURPOSE AND OBJECTIVES OF CYBERNETIC TREATMENT OF PSYCHOLOGICAL PROBLEMS AND SOME PROBLEMS OF THIS PSYCHOLOGICAL RESEARCH IN THE GDR F. Klix (Humboldt U., E. Berlin) p 92–107 refs

11. CYBERNETICS AND PROFESSIONAL EDUCATION H. Kelbert (Ger. Inst. for Vocational Training, E. Berlin) p 108–151 refs

12. SOME REMARKS ON THE CONCEPT OF INFORMATION H. Metzler (Humboldt U., E. Berlin) p 154–157

13. MEDICINE, BIOLOGY AND CYBERNETICS H. Drischel (Karl Marx U., Leipzig) p 158–195 refs

N64-14143 Joint Publications Research Service, Washington, D.C.

BIOLOGY AND CYBERNETICS

Aleksand'r Goranov 29 Jan. 1964 17 p refs Transl. into ENGLISH of an article from Biol. Khim. (Bulgaria), v. 6, no. 5, 1963 p 1–8

(JPRS-22963; OTS-64-21424) OTS: $0.50

Biology and cybernetics are reviewed. Biology, by using the attainments of cybernetics, will be enriched with new ideas. Cybernetic devices will aid in the discovery of new biological secrets, which, as they are analyzed and applied in cybernetics, will lead to still greater progress in this science. Cybernetics, as it discloses the general laws for the coordination and regulation of the internal processes in living organisms and modern cybernetic devices, is already in a position to simulate biological processes and to create complex devices which even reproduce certain functions of the second signal system of man. The theory of feedback "afferentiation" includes within it the theory of feedback evolved by cybernetics, so that it may serve for analysis of all forms of self-regulating processes as well as for the construction of analogous self-regulating cybernetic devices. The theory of feedback in physiology and cybernetics does not contradict Pavlov's conception of the reflex but develop it further. I.v.L.

N64-14148 Joint Publications Research Service, Washington, D.C.

THE NATURE OF MICRONECROTIC FOCI OF HEMOPOIETIC ORGANS OF ANIMALS EXPOSED TO RADIATION

M. N. Meysel' and V. M. Manteyfel' 27 Jan. 1964 14 p refs Transl. into ENGLISH of an article from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 6, 1963 p 871–878

(JPRS-22915; OTS-64-21398) OTS: $0.50

The rapid drying in air of smears from hemopoietic organs of white rats, which have been fluorochromed *in vivo* and supravitally, makes it possible to preserve a number of features in the luminescence of normal and pathological cells. By using this method, the micronecrotic foci that arise in the hemopoietic organs of radiated animals were identified as the macrophages which phagocytize the cells and their fragments. The dynamics in the appearance, quantitative growth, and fall of the micronecrotic foci, after the irradiation of the animals, reflects the dynamics in the mobilization of the macrophages and the activation of their phagocytic function. Micronecrotic foci were also experimentally produced by injecting damaged lymphocytes in the spleen and lymph nodes of normal rats. The changes observed in the character of the ultraviolet luminescence emitted by the macrophages and phagocytized cells reflect the different stages in the intracellular digestion of these cells. I.v.L.

N64-14149 Joint Publications Research Service, Washington, D.C.
PROSPECTS OF THE USE OF OPTICAL QUANTUM OSCILLATORS IN BIOLOGY AND MEDICINE
A. A. Vishnevskiy and S. N. Braynes 30 Jan. 1964 8 p Transl. into ENGLISH of an article from Eksperim. Khirur. i. Anesteziol. (Moscow), no. 6, 1963 p 3–5
(JPRS-22994; OTS-64-21438) OTS: $0.50

The use of lasers in experimental biology is very promising. Since lasers are a source of high-intensity radiation in a narrow spectral range, it is possible that they will prove to be an effective agent for delicate instrumentation in metabolic processes by the selective stimulation of molecules involved in these processes. Also, that laser radiation will display mutagenic properties is not out of the question. Mutations under such circumstances could be the result of the interaction of infrared and visible radiation with molecular complexes, the carriers of heredity. Lasers have been successfully used in eye surgery. A beam was focused onto a small point on the retina, and detached parts of the retina were "welded" without damage to surrounding tissue. Malignant tumors have been cauterized with lasers. It is expected that lasers will play a large part in heart and nerve surgery and in the study of carcinomatous diseases. I.v.L.

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems.

N64-13418 Joint Publications Research Service, Washington, D.C.
SUBMERGED-ARC WELDING OF OT4 TITANIUM-ALLOY PARTS
V. B. Voklov (Acad. Sci. Ukr. SSR) and O. A. Maslyukov *In its* Selections on Titanium and its Alloys from Avtomat. Svarka 30 Dec. 1963 p 1–7 refs Transl. into ENGLISH of p 33–36 (See N64-13417 05-01) OTS: $0.75

Automatic submerged-arc welding techniques were used to manufacture titanium alloy parts in order to establish an optimum system of welding ring-shaped and longitudinal butt seams of parts. The quality of the welded joints was evaluated, and control assemblies were tested. The welding of joints of experimental units (butt-ring and longitudinal) showed that good quality seams were obtained. The X-ray radioscopy and investigation of sections cut from the control parts established that the seams contained no flaws. The high quality of the welded joints was also confirmed by hydraulic breaking tests of the units. R.T.K.

N64-13419 Joint Publications Research Service, Washington, D.C.
ELECTROSLAG MELTING OF TITANIUM-ALLOY INGOTS
S. M. Gurevich, V. P. Didkovskiy, and Yu. K. Novikov (Acad. Sci. Ukr. SSR) *In its* Selections on Titanium and its Alloys from Avtomat. Svarka 30 Dec. 1963 p 8–16 refs Transl. into ENGLISH of p 37–42 (See N64-13417 05-01) OTS: $0.75

An electroslag method of melting titanium ingots, possessing a number of technological advantages in comparison with the existing industrial methods of melting, has been developed. A technology for electroslag melting, guaranteeing the production of high-quality titanium-alloy ingots, has been proposed. Author

N64-13420 Joint Publications Research Service, Washington, D.C.
JOINING TITANIUM BY VACUUM-DIFFUSION WELDING
N. F. Kazakov, A. P. Shishkova, and K. Ye. Charukhina *In its* Selections on Titanium and its Alloys from Avtomat. Svarka 30 Dec. 1963 p 17–24 refs Transl. into ENGLISH of p 82–86 (See N64-13417 05-01) OTS: $0.75

Experiments on joining titanium by vacuum-diffusion welding were conducted under the following system: temperature 800°, 850°, 900°, 1000°, and 1100° C. The pressure selected was in the range of 0.25 to 1 kg/mm^2. The duration of the process was 10 sec, 1, 5, 7, and 10 minutes. Tests of samples welded at low temperatures (800° and 850° C), with pressure 0.5, to 0.8 kg/mm^2, and exposure of 1 to 5 minutes, showed that these systems do not guarantee stable results. Most of the samples broke down at the site of the weld. However, a strong joint can be obtained when the exposure time is increased to more than 5 minutes at the same temperatures as well as at higher temperatures. R.T.K.

N64-13577 Joint Publications Research Service, Washington, D.C.
RESILIENT GUIDES IN DEVICES. (A REVIEW)
V. N. Zheludkov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 135–153 refs (See N64-13565 05-01) OTS: $3.00

Guides for forward motion (spring parallelograms, twin-spring parallelograms, annular guides) and for rotary motion (band pivots, cross-pivots, two-band pivots, three-band pivots, annular hinges) are reviewed. The most prominent investigations and equations for design of guides are given for each examined type. Several examples of applications of resilient friction guides used in various devices are described. Author

N64-13580 Joint Publications Research Service, Washington, D.C.
CALCULATION OF ERRORS IN MACHINING PARTS BY THE METHOD OF LATERAL TURNING AND RADIAL FEED
M. A. Luzhnikovskaya *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 176–183 refs (See N64-13565 05-01) OTS: $3.00

The stages of elastic deformation brought about by lateral turning are described, and equations are cited for calculating and determining the errors in diametrical dimensions caused by these deformations. Author

N64-13588 Los Alamos Scientific Lab., N. Mex.
OPERATING INSTRUCTIONS, PROCEDURES, AND EQUIPMENT FOR THE LOS ALAMOS PLUTONIUM ELECTROREFINING PLANT
L. J. Mullins, J. A. Leary, and A. N. Morgan 18 Dec. 1963 36 p refs
(Contract W-7405-eng-36)
(LA-2981) OTS: $0.75

Fused salt electrorefining processes have been developed for producing high-purity high-density plutonium metal on the 500 g and 3.5 kg scales. The purpose of this report is to present in detail the operating instructions, procedures, and equipment recommended for use in the Los Alamos electrorefining plant now in construction. Author

N64-13598 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE APPLICATION OF ULTRASONIC ENERGY IN THE DEFORMATION OF METALS Report on an Informal Symposium
A. R. Rosenfield 16 Aug. 1963 78 p refs Presented at Bur. of Naval Weapons Symp., Washington, D.C., 21 Jun. 1963
(Contract AF 33(616)-7747)
(DMIC-187; AD-423562)

The symposium reports revealed that the results achieved by incorporating ultrasonic transducers into conventional metal-forming and -cutting operations are sufficiently promising that the technique merits further attention. Data are available to indicate that application of ultrasonic vibrations during metal-working can increase speeds, lower forces, and improve surface finishes. All of these results have been obtained without any observed difference in properties between ultrasonically and conventionally fabricated parts. Author

N64-13605 Technische Hochschule Munchen (W. Germany)
EXPERIMENTS AND INVESTIGATIONS ON HEAT TRANSFER BY LIQUIDS AT OR NEAR THEIR CRITICAL POINTS Final Report, Including the Quarterly Reports No. 13-No. 20
Ernst Schmidt 30 Jul. 1963 126 p refs
(Contract N62558-1906)
(AD-426252)

Materials used in the cooling systems of industrial, technical, and scientific apparatus were studied. Consideration was given to heat transfer by free or natural convection in the neighborhood of the critical state of the cooling liquid and to experiments, which have resulted in new and unexpected observations about the influence of gravity on the behavior of the fluid near its critical state. C.L.W.

N64-13611 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURES TO INCREASE TRANSISTOR RELIABILITY Third Quarterly Progress Report, 1 Jan.-31 Mar. 1963
Earl R. Gomersall et al [1963] 75 p
(Contract DA-36-039-SC-86730)
(AD-424973)

CONTENTS:
1. PRODUCTION ENGINEERING MEASURES TO INCREASE TRANSISTOR RELIABILITY. ITEM 4 [SILICON TRIPLE DIFFUSED TRANSISTOR TYPE 2N656] E. R. Gomersall, E. A. Wolff, M. K. Mack, and J. H. Overman p 1-37 (See N64-13612 05-17)

2. PRODUCTION ENGINEERING MEASURES TO IMPROVE TRANSISTOR RELIABILITY. ITEM 9 [SILICON GROWN JUNCTION TRANSISTOR TYPE 2N333] S. McCleese, D. Briggs, S. A. Robinson, F. Thurmond, Jr., and R. L. Petritz p 38-71 (See N64-13613 05-17)

N64-13612 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURES TO INCREASE TRANSISTOR RELIABILITY. ITEM 4 [SILICON TRIPLE DIFFUSED TRANSISTOR TYPE 2N656]
Earl R. Gomersall, Elmer A. Wolff, Milton K. Mack, and James H. Overman *In its* Production Eng. Meas. to Increase Transistor Reliability [1963] p 1-37 (See N64-13611 05-17)

Progress was made in the following areas: (1) Planar production diffusion processes are being optimized. Mesa diffusion process specifications have been tightened to take full advantage of improved capabilities. (2) Contact window stains have been minimized, and the quality and control of the evaporated contacts have been greatly improved. (3) Ultrasonic cold bonding of aluminum wire to evaporated aluminum contacts and aluminum wire welded to gold-plated header posts are passing all tests satisfactorily. (4) The planar device is being placed into production, and yields and quality are good. Author

N64-13613 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURES TO IMPROVE TRANSISTOR RELIABILITY. ITEM 9 [SILICON GROWN JUNCTION TRANSISTOR TYPE 2N333]
Sam Mc Cleese, Doyce Briggs, Sam Robinson, Fred Thurmond, Jr., and R. L. Petritz *In its* Production Eng. Meas. to Increase Transistor Reliability [1963] p 38-71 (See N64-13611 05-17)

The areas of engineering activity were as follows: (1) material preparation, (2) thermal dissipation of package, (3) assembly (4) cleaning techniques to obtain optimum surface condition for all fabrication processing, (5) final preparation prior to sealing, (6) controlled formation of surface oxides, (7) welding and gettering techniques for encapsuling and sealing, (8) postweld conditioning. Author

N64-13635 Raytheon Co., Lewiston, Me. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE RELIABILITY IMPROVEMENT SILICON ALLOY TRANSISTOR Quarterly Report No. 4, 1 Apr.-30 Jun. 1963
R. W. Jones, A. W. Postlethwaite, and L. F. Leary [1963] 34 p refs
(Contract DA-36-039-SC-86744)
(AD-425441)

Progress was reported in the following areas: (1) Dimensional control of the chip is complete and in production. (2) Float zone silicon crystal was put into full production use with specified controls on all bulk parameters. (3) Electrical evaluation of subassembly basewidth was incorporated into production. (4) An optimum basecoat curing cycle was evaluated and made part of the production process. (5) An optimum post seal stress cycle was incorporated into production. Author

N64-13640 Motorola, Inc., Phoenix, Ariz.
RESEARCH AND DEVELOPMENT FOR SURFACE PROTECTION FOR SILICON DEVICES Scientific Report No. 5
S. S. Flaschen, H. W. Cooper, and M. A. Hall 14 Sep. 1963 40 p
(Contract AF 19(604)-8358)
(AFCRL-63-536; AD-426002)

This report describes the progress made in the control and application of semiconductor device surfaces, and in the electrical evaluation of device passivation coatings. Lithium-peroxide-controlled ambient material was applied to a substantial number of high-reliability diffused switching transistors which have demonstrated favorable life-test results. Surface oxidation by solution treatments has demonstrated improved collector breakdown-voltage characteristics in a number of germanium-alloy devices. A hypothetical model is proposed for alumina-silica films, and preliminary evaluations of an experimental film are presented. Author

N64-13680 Joint Publications Research Service, Washington, D.C.
PROCESSING AND PRELIMINARY INVESTIGATIONS OF THE MAIN MIRROR (2.6-m) FOR THE TELESCOPE OF THE CRIMEAN ASTROPHYSICAL OBSERVATORY
V. V. Oshurko *In its* New Methods in Astronomy 10 Jan. 1964 p 24–33 (See N64-13676 05-01) OTS: $3.00

A description is presented of the special grinding and polishing procedures used in construction of the 2.6-m mirror. P.V.E.

N64-13727 Joint Publications Research Service, Washington, D.C.
THE IODIDE METHOD OF REFINING ZIRCONIUM. THE TRANSFER OF NONMETALLIC ADDITIONS DURING REFINING
V. S. Yemel'yanov, A. I. Yevstyukhin, and D. D. Abanin *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 1–7 refs (See N64-13726 05-01) OTS: $3.00

Successful efforts to reduce the content of nonmetallic impurities in zirconium and zirconium iodide by iodide refining are reported. A device is described which facilitates separately degassifying the metal at high temperatures and then refining it at lower temperatures (300° to 320° C). As a result of a single iodine refining using this method, zirconium was obtained with lower carbon, oxygen, nitrogen, and hydrogen contents than was obtained using triple refining by the conventional iodide method. Up to 95% of the zirconium was recovered, and the rods of zirconium iodide obtained were extremely plastic with very clean grain boundaries and very high corrosion resistance. M.P.G.

N64-13731 Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE DISTRIBUTION OF ADDITIONS IN NIOBIUM AFTER ZONE REFINING
A. I. Yevstyukhin, V. V. Nikishanov, and I. V. Milov *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 46–63 refs (See N64-13726 05-01) OTS: $3.00

Experiments conducted on the zone recrystallization of niobium by the electric arc method in a copper crucible show that effective refinement of additions of carbon, iron, lead, and tungsten can be achieved. Further, radioisotope experiments confirmed the theoretical distribution factors of carbon, iron, and tungsten which were determined from the phase diagrams of the alloys Nb-C, Nb-Fe, and Nb-W, i.e., tungsten concentrated in the first part of the niobium ingot and iron and carbon in the last part. Some refinement also occurred during arc zone recrystallization as a result of vaporization, particularly of the volatile additions and metals that form volatile compounds. M.P.G.

N64-13833 Aeroprojects Inc., West Chester, Pa.
DEVELOPMENT OF ULTRASONIC WELDING EQUIPMENT FOR REFRACTORY METALS Interim Technical Progress Report, May-Jul. 1962
Nicholas Maropis Aug. 1962 44 p 2 refs
(Contract AF 33(600)-43026)
(ASD-TR-7-888(4); AD-286165) OTS: $4.60

Design of the welded framework and various welding control circuits has been completed. Evaluations have continued in isolating and resolving problems relating to critical components of the 25-kw unit, among which are ceramic washer-type transducer assemblies, acoustic coupling elements, and power-force programing circuitry. Author

N64-13876 Barden Corp., Danbury, Conn.
INVESTIGATION OF UNCONVENTIONAL BEARINGS [Final Report, 1 Jul. 1962-1 Jul. 1963]
John J. Murphy et al Wright-Patterson AFB, Ohio, AF Flight Dynamics Lab., Jun. 1963 156 p refs
(Contract AF 33(657)-8729)
(ASD-TDR-63-709; AD-421997)

The investigation of unconventional approaches to the problem of providing a dynamic support in an aerospace environment is the object of this research. The report covers solid, liquid, gaseous and metallic lubricants, rolling element, journal and gas bearings, electric and acoustic force field supports, seals, cooling, and means of preserving lubricants and surfaces. Several systems utilizing a combination of operating principles or devices are proposed which meet the aerospace environmental conditions. One system, the gas bearing with molecular pump seal, is recommended as most likely of success. An extensive bibliography is included. Author

N64-13887 Lockheed-Georgia Co., Marietta
ESTABLISH THE GENERAL USE OF CERAMIC TOOLS IN PRODUCTION Interim Report
C. M. Head 5 Apr. 1963 14 p refs
(Contract AF 33(600)36888)
(GMRI 660.03; AD-427698)

Four additional layup blocks are now used in production. Tool wear problems of the hot sizing die have been largely eliminated. The release of fiberglass parts from the tool has been facilitated through the development of a tool surface "slickening" technique and an improved release agent. Author

N64-13910 Aeronautical Research Council (Gt. Brit.)
THE INFLUENCE OF A WIDE HUB ON THE ROOM TEMPERATURE BURST STRENGTH OF MODEL STEAM TURBINE ROTORS
N. E. Waldren and D. E. Ward London, HMSO, Mar. 1963 50 p refs
(ARC-CP-661; supersedes NGTE-M-363 and ARC-24587)
Available from HMSO: 10s 6d

A number of model steam-turbine rotors in various materials have been spun to burst to study the influence of increased hub width on rotor strength. Substantial strain in the midbore region is the result of a compressive stress which, although improving the ductility of the material, can produce local plastic deformation at low rotor speeds. Failure in the rotors has been caused by a high ratio of biaxial tension near the rim, and some changes in design are suggested to reduce this ratio, which severely limits the ductility of the material. Author

N64-13945 Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
PERFORMANCE OF A MULTI-STAGE CENTRIFUGAL CONTACTOR
A. A. Kishbaugh Oct. 1963 29 p refs
(Contract AT(07-2)-1)
(DP-841) OTS: $0.75

A five-stage centrifugal contactor with 10-in.-diam. stages processed natural or enriched uranium solutions by solvent extraction. High mass-transfer efficiencies for uranium were attained at total flow rates of at least 40 and 60 gpm, respectively. The unit had a hydraulic capacity in excess of 60 gpm with undiluted tri-n-butyl phosphate as the solvent, provided the aqueous phase contained at least 3M HNO_3. Author

N64-13979 Silicon Transistor Corp., Carle Place, N.Y.
PRODUCTION ENGINEERING MEASURE TO INCREASE THE RELIABILITY OF THE TRANSISTOR TYPE 2N2034 Quarterly Progress Report No. 1, 22 Jun.-30 Sep. 1963
J. Cocking, J. Courier, F. Des Roches, D. Hughes, and E. Martin [1963] 53 p refs
(Contract DA-36-039-AMC-01482(E))
(AD-426410)

In the area of process improvement, significant progress has been made in wafer cleaning, mesa delineation, and scribing. A control lot of 130 units had been obtained from the regular manufacturing line. A detailed discussion on work performed is reported herein on the basis of individual task. The units from one control lot manufactured by the standard production line and two lots made in TASK 1D have been subjected to tests, and the data have been analyzed. Author

N64-13990 Crystalonics, Inc., Cambridge, Mass.
PRODUCTION ENGINEERING MEASURE TO IMPROVE PRODUCTION TECHNIQUES AND TO INSURE THE RELIABILITY OF THE C600 SERIES FIELD EFFECT TRANSISTORS Quarterly Report No. 1, 1 Jul.-30 Sep. 1963
John R. Williams [1963] 42 p
(Contract DA-36-309-AMC-01483(E))
(AD-426356)

Improvements were made in the diffusion equipment and technique. Bulk diffusion was studied, and graphs were presented of diffusion distance versus time. Studies were also made of the diode characteristics as a function of diffusion condition. Preliminary evaluations of ultrasonic bonder devices were made. Several prototype designs of the etching fixture were fabricated and evaluated. Author

N64-14004 Westinghouse Electric Corp., Philadelphia, Pa.
PRODUCTION ENGINEERING MEASURE, TYPE 2N1016B SILICON ALLOY TRANSISTOR Quarterly Progress Report No. 4, covering the Period through June 30, 1963
S. Chinowsky et al [1963] 27 p
(Contract DA-36-039-SC-86743)
(AD-425525)

Completion of five process improvements, the progress and status of five phases, and abandonment of one phase of the contract are reported. Further data on the step-stress program are given. An operating life step-stress program is described, and early results are presented. Results of a second temperature step-stress program on an improved product are discussed. Author

N64-14026 Pratt and Whitney Aircraft, East Hartford, Conn.
SOLID FILM LUBRICATED BEARING RESEARCH Second Quarterly Progress Report, [1 Aug.-31 Oct. 1963]
Paul Brown, M. Pitek, and M. Maguire 3 Dec. 1963 34 p refs
(Contract AF 33(657)-10420)
(PWA-2288; AD-425142)

The bearing-torque test rig was assembled to check for design discrepancies and, after finding no problems, the rig was instrumented for initial operational checks. Solid-lubricant compact thermal-expansion tests have been completed on five specimens. Author

N64-14042 Arde-Portland, Inc., Paramus, N.J.
CRYOGENIC STRETCH-FORMING OF SOLID-PROPELLANT ROCKET CASES Quarterly Technical Report No. 5, 1 Jun.-31 Aug. 1963
George Claffy [1963] 16 p
(Contract DA-30-069-ORD-3501)
(AD-420080)

Design work was completed on the preform vessels which will be cryogenically stretched to produce the final subscale cases. The preform vessels utilize dog-bone-type closures to produce the proper contours after stretching. Hydroformed parts are used for the dog-bone closures in the subscale vessels, and procurement of these parts was completed. Design of a fixture to mechanically expand the nozzle end joint at −320° F was completed. The fixture will work a 301-stainless-steel ring in a liquid-nitrogen bath in such a way as to provide adequate strength for use as the nozzle connection joint. Author

N64-14060 Joint Publications Research Service, Washington, D.C.
EQUIPMENT FOR PROCESSING REFRACTORY METALS IN THE ELECTROVACUUM INDUSTRY
A. T. Aleksandrova et al 24 Jan. 1964 205 p refs Transl. into ENGLISH of the book "Oborudovaniye dlya obrabotki tugoplavkikh metallov v elektrovakuumnom proizvodstve" Moscow, Gosenergoizdat, 1963 p 1–80
(JPRS-22894; OTS-64-21388) OTS: $3.50

A textbook on equipment designed for chemical, mechanical, and thermal treatment (with greater emphasis on mechanical and thermal treatments than on chemical treatments) of tungsten and molybdenum, used in electrovacuum production, is presented. The general subjects covered are: equipment for producing metallic tungsten and molybdenum powders, equipment for producing compact tungsten and molybdenum, equipment for manufacturing tungsten and molybdenum wire, equipment for rolling extra thin ribbons and spreading of wire, and equipment for production of extremely pure high melting metals. P.V.E.

N64-14079 British Hydromechanics Research Assn., Harlow
A BIBLIOGRAPHY ON BUTTERFLY VALVES
Aug. 1963 17 p 76 refs
(BIB-14)

Included is an annotated bibliography, an author index, and notations on which publications can be found in the British Hydromechanics Research Association Library. R.T.K.

N64-14098 Stanford U., Calif.
THE PRESENT STATUS OF STATISTICAL PROCESS CONTROL
Gerald J. Lieberman 6 Dec. 1963 20 p refs
(Contract Nonr-225(53))
(Tech. Rept. 71; AD-426244)

Control charts aid in: (1) the determination of process capabilities; (2) the detection and identification of assignable causes of variation; and (3) correction of the process. Related

to process control and control charts are continuous sampling plans. The ways in which continuous sampling plans can be used for control of in-process material are discussed. Adaptive control procedures are also examined. R.T.K.

N64-14123 Westinghouse Electric Corp., Philadelphia, Pa.
PRODUCTION ENGINEERING MEASURE, TYPE 2N1814 SILICON ALLOY TRANSISTOR Quarterly Progress Report No. 1, covering Period through 30 Sep. 1963
T. Csakvari et al [1963] 19 p refs
(Contract DA-36-039-AMC-03617(E))
(AD-427890)

The current program status includes the following: (1) Change in the collector junction design is needed to eliminate premature secondary breakdown. (2) Diffused collector devices are being fabricated as standard 2N1814 devices. (3) The effect of electrode spacing will be minimized in power transistors by diffusion of a p-type skin to reduce the resistivity of the base contact area. (4) A metallized ceramic contact has been designed to provide full area emitter and base contact. (5) Improvements are underway to improve the control of the vacuum fusion furnace; (6) The optimization of the control of the hard solder furnace is also underway. (7) Improved handling techniques and critical control equipment are being developed to ensure the maximum effectiveness of molecular sieves. (8) A prototype circuit has been developed for performing a pulsed peak-power test. I.v.L.

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see:* 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-13589 Los Alamos Scientific Lab., N. Mex.
SOLID PLUTONIUM FUELS PROGRAM Quarterly Status Report, 1 Jul.-30 Sep. 1963
J. A. Leary, W. J. Maraman, W. N. Miner, and F. W. Schonfeld
31 Dec. 1963 9 p refs
(Contract W-7405-eng-36)
(LAMS-3023) OTS: $0.50

Activities in the following areas are discussed: (1) Preparation of oxides—The effect of small amounts of silicon in PuO_2 was determined by sintering PuO_2 that contained 600 ppm Si. After 6 hr at 1650° C in dry Ar, the microstructure clearly showed a phase that was distinct from either PuO_{2-x} or α-Pu_2O_3. (2) Preparation of PuN—The effect of preparative condition of PuN powder properties (using a method of preparation based on the reaction of N_2 with Pu metal, catalyzed by addition of H_2) was investigated. Results show that it is advantageous to use small amounts (1% to 2%) of H_2 catalyst. (3) Properties of compounds and alloys—Measurement of the electrical resistivities of $(U_{0.80}Pu_{0.20})C$ and $PuC_{1.0}$(PuC_{1-x} and Pu_2C_3) were measured, and the results indicated that the solid solution $(U_{0.80}Pu_{0.20})C$ is principally a metal-like conductor up to 350° C. The temperature coefficient of $(U_{0.80}Pu_{0.20})C$ is +0.142 $\mu\Omega$cm and the coefficient for $PuC_{1.0}$ is zero up to 350° C and +0.031 $\mu\Omega$cm between 400° and 800° C. (4) Metallurgy studies on the plutonium–silicon systems—the crystal structure of Pu_5Si_3 is tetragonal, space group $I4/mcm$, with $a = 11.409 \pm 0.004$ and $c = 5.448 \pm 0.003$ A. (5) Studies of the plutonium-carbon-oxygen system—The plutonium–carbon–oxygen phase diagram indicated that PuC will dissolve about 25 a/o oxygen to form a single-phase Pu(C,O) region; there are two two-phase regions, one involving Pu(C,O) and the other involving Pu(C,O) and liquid plutonium, and two three-phase triangles, one involving Pu(C,O), Pu_2O_3, and liquid plutonium, and the other involving Pu(C,O), Pu_2C_3, and Pu_2O_3. P.V.E.

N64-13591 Aerojet-General Corp., Azusa, Calif. Structural Materials Div.
INVESTIGATION OF STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS [Twenty-first Informal Monthly Progress Report, 1 Jan.-31 Jan. 1963]
R. B. Setterlund Apr. 1963 13 p refs
(Contract DA-04-495-ORD-3069)
(LO414-01-21; AD-401837)

Data obtained to date show that the 6Al-4V titanium alloy is immune to stress-corrosion cracking under all the test conditions of this program in both the annealed and in the quenched-and-aged conditions. The 20%-nickel maraging steel was found to be susceptible to stress-corrosion cracking in both the annealed-and-aged and in the 75% cold-worked conditions. The susceptibility is much greater, however, in the annealed condition. The 18%-nickel maraging steel was also found to be susceptible to stress-corrosion cracking in both the annealed-and-aged and cold-worked-and-aged conditions. As with the 20%-nickel alloy the annealed-and-aged condition showed the greater susceptibility. Among the test environments employed, the most severe exposures were those in moisture-saturated air at 140° F, a 3%-salt water solution, and distilled water. Author

N64-13592 Aeroprojects, Inc., West Chester, Pa.
INVESTIGATION OF ULTRASONIC WELDING OF REFRACTORY METALS AND ALLOYS Bimonthly Progress Report No. 6, 16 Jun.-15 Aug. 1963
Sep. 1963 25 p refs
(Contract NOw-63-0125-c)
(AD-422935)

Ultrasonic welds in Inconel X-750 and in molybdenum-0.5% titanium alloy, produced with power-force programing, showed significantly higher strengths than those made with conventional power and force application. Metallographic examination of the molybdenum alloy welds revealed superior bonding. Author

N64-13606 Boeing Co., Seattle, Wash. Aero-Space Div.
INVESTIGATION OF LOW-CYCLE FATIGUE FAILURES USING APPLIED FRACTURE MECHANICS Progress Report [15 Jun.-15 Oct. 1963]
C. F. Tiffany et al Oct. 1963 44 p refs
(Contract AF 33(657)-10251)
(AD-422404)

This report compares cyclic flaw-growth data generated using sharply notched round-bar and surface-flawed 6Al-4V titanium specimens tested at −320° F and illustrates the applicability of such data to predicting the minimum cyclic life span of pressure vessels. Similar data were also obtained and are shown for Ladish D6A-C steel plate tested at room temperature. The mechanical properties and static fracture toughness of 18Ni (300) tested at room temperature are also given. Author

N64-13641 Pennsylvania State U. University Park, Pa.
FIELD ION MICROSCOPY OF IRON WHISKERS [Final Report]

Erwin W. Muller and Osamu Nishikawa Wright-Patterson AFB, Ohio, AF Materials Lab., Nov. 1963 27 p refs
(Contract AF 33(616)-6397)
(ASD-TDR-63-138, Pt. 2; AD-426698)

Field ion microscopy of nonrefractory metals has been improved by the use of neon and neon–helium gas mixtures. A limited number of iron whiskers has been observed and found to contain a high density of lattice defects, such as impurity atoms, single dislocations, and dense dislocation areas of an almost amorphous structure, particularly in the 111 region. The latter defect is an artifact caused by the stress of the evaporation field. Further progress will depend upon a reduction of this field, and the use of an image intensifier. Author

N64-13648 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
SHORT-TIME TENSILE PROPERTIES OF THE Co-20Cr-15W-10 Ni COBALT-BASE ALLOY (L-605)
C. J. Slunder 27 Sep. 1963 145 p refs
(Contract AF 33(616)-7747)
(DMIC Memo. 179; AD-425922)

Data which have been selected covering the short-time tensile properties of Co-20Cr-15W-10Ni are presented. These data are discussed under four general headings: (1) room-temperature tensile properties; (2) short-time, elevated-temperature tensile properties; (3) tensile properties of welded and brazed joints; and (4) tensile properties at cryogenic temperatures. R.T.K.

N64-13671 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE ENGINEERING PROPERTIES OF MOLYBDENUM AND MOLYBDENUM ALLOYS
F. F. Schmidt and H. R. Ogden 20 Sep. 1963 293 p refs
(Contract AF 33(616)-7747)
(DMIC-190; AD-426264)

This report presents the results of a state-of-the-art survey covering molybdenum and nine of its most promising alloys. All data are given in tabular and graphical form covering some of the more important physical, mechanical, and metallurgical properties for each material. References are given at the conclusion of each material section. Author

N64-13672 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
HOT-COLD WORKING OF STEEL TO IMPROVE STRENGTH
Charles W. Marschall 11 Oct. 1963 74 p refs
(Contract AF 33(616)-7747)
(DMIC-192; AD-425948)

The constant trend toward use of higher-strength materials has led to the investigation of new techniques for improving the properties of steels. This report is a somewhat more detailed review of one of these techniques, namely deformation of austenite without recrystallization, prior to its transformation. Although this is frequently called" ausforming," the present report uses the term "hot-cold working" because it covers a broader range of deformation temperatures. Author

N64-13724 Massachusetts Inst. of Tech., Cambridge Metals Processing Lab.
THE STRENGTH AND PLASTICITY OF ANISOTROPIC METALS Final Report
W. A. Backofen and W. F. Hosford, Jr. Sep. 1963 59 p refs
(Contract DA-19-020-ORD-5719)
(WAL-TR-834.12/2-3; AD-425880)

Sheets of the magnesium alloys AZ31B, HK31A, and ZE10A in several different tempers were tested in tension, and determinations were made of the ratio of width-to-thickness strains. A marked increase in the ratio with tensile straining and a dependence upon alloy and test direction are rationalized in terms of a balance between the amounts of basal- and prism-plane slip. All such variations are related, in turn, to the prevailing crystallographic texture. Fracture appearance is explained on the basis of anisotropy in plastic flow, and implications for developing texture-hardening effects in these alloys are discussed. Author

N64-13729 Joint Publications Research Service, Washington, D.C.
THE FORMATION OF SCALE WITH A STRUCTURE $6ZrO_2 \cdot Nb_2O_5$ ON ALLOYS OF ZIRCONIUM WITH NIOBIUM
Yu. F. Bychkov, V. A. Ivanov, and A. N. Rozanov *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 27–38 refs (See N64-13726 05-01) OTS: $3.00

The composition of the scale which forms in air on the alloys Zr-25%Nb and Zr-15%Nb-10%Mo was investigated because of the possibility that a new unknown oxide film might be the explanation for the high heat resistance of these alloys. X-ray techniques showed that a compound of $6ZrO_2 \cdot Nb_2O_5$ forms at the surface along with ZrO_2; the amount of $6ZrO_2 \cdot Nb_2O_5$ formed during strong oxidation at 1200° C approaches 100%. Preliminary oxidation of these alloys at lowered pressures at 1200° C somewhat increases their resistance to oxidation at 700° C, but this increased resistance is shown not to be due to the formation of $6ZrO_2 \cdot Nb_2O_5$. Also, the high oxidation resistance of Zr-25%Nb at temperatures below 600° C must be due to some factor other than the formation of $6ZrO_2 \cdot Nb_2O_5$ since the content of this compound in the oxide film formed at this temperature is very low. M.P.G.

N64-13737 Joint Publications Research Service, Washington, D.C.
CHANGES OF PROPERTIES DURING CYCLIC THERMAL TREATMENT, DURABILITY, AND INTERNAL FRICTION OF SAP
A. I. Dashkovskiy, A. N. Rozanov, Yu. F. Bychkov, and I. D. Laptev *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 124–138 refs (See N64-13726 05-01) OTS: $3.00

The behavior of SAP-1 (sintered aluminum powder), SAP-2, and technical aluminum AD-1 was investigated during cyclic changes of temperature. The experiments on dimensional stability have shown that significant changes in dimension of SAP plates occur when the maximum temperature of cycle is 550° C or higher and for rods, 600° C. During the study of recrystallization of SAP it was found that in cold deformed SAP the process of growth of recrystallization centers is separated by a significant temperature interval. The formation of recrystallization nuclei has a smaller effect on the weakening of the material than on growth. SAP-1, plate rolled from vacuum annealed briquet at 700° C for 2 hours, after 10 cycles of heating up to 600° C had no cracks, blisters or large pores which would result in changes in mechanical properties. C.L.W.

N64-13738 Joint Publications Research Service, Washington, D.C.
THE MECHANICAL PROPERTIES OF BERYLLIUM AFTER ZONE RECRYSTALLIZATION
I. V. Milov, D. M. Skorov, and V. V. Nikishanov *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 139–145 refs (See N64-13726 05-01) OTS: $3.00

This article describes results of compression tests on specimens which were cut from beryllium ingots that had been subjected to zone recrystallization. The mechanism of

deformation of the polycrystalline specimens was studied using X-ray photography. The X-ray photographs obtained made it possible to arrive at the conclusion that the grains constitute monocrystals with misorientation of the block to the extent of several degrees. The microhardness of vertical sections of the specimens was measured. It was established that in sections subjected to the recrystallization zone with a varying number of passes, the microhardness of vertical sections increases from the lower layers to the upper ones. C.L.W.

N64-13763 Aerospace Corp., El Segundo, Calif. Labs. Div.
A MICROPLASTICITY STUDY OF DISPERSION STRENGTHENING IN TD-NICKEL
J. E. White and R. D. Carnahan 20 Dec. 1963 32 p refs
(Contract AF 04(695)-269)
(TDR-269(4240-10)-4; SSD-TDR-63-346; AD-426988)

A study of dispersion strengthening in TD-Nickel (nickel plus two volume percent ThO_2) was conducted employing microstrain techniques at ambient room temperature. It was found that optimum strength was due primarily to the incorporation of stored energy developed by a variety of thermal–mechanical treatments. The relatively low strength of the recrystallized condition implies that the dispersed particles themselves offer only token resistance to deformation. The development of resistance to large scale recovery or recrystallization at temperatures near the melting point requires a more extensive sequence of strain-anneal cycles than does the development of optimum strength. A micro-Bauschinger effect was observed which appears to be related to the lattice resistance to the movement of free dislocations. The effect was nearly identical to that in pure nickel indicating that the presence of the dispersed phase and considerably increased dislocation density (stored energy) only alters the number or effectiveness of barriers. Author

N64-13767 Hughes Tool Co., Culver City, Calif. Aircraft Div.
MECHANICAL PROPERTIES OF WROUGHT TUNGSTEN, VOLUME I Technical Documentary Report [Jun. 1960–Dec. 1961]
H. Leggett and H. Parechanian Wright-Patterson AFB, Ohio, AF Mater. Lab., Nov. 1963 141 p
(Contract AF 33(616)-7385)
(ASD-TDR-63-585, Vol. 1; AD-427126)

The mechanical properties and quality of commercially available tungsten sheet were investigated. For the initial quality-control phase, hardness, microstructure, chemical impurities, flexural properties, and tensile strength were determined on material from three sources. Based on these test results a specification requiring high-quality material with high cold reduction was formulated. For the second phase of testing, three powder lots of tungsten sheet were procured from five sources. The tensile test results on this material are presented for room temperature, 1000°, 2000°, 3600°, and 4400° F. Good correlation between room-temperature hardness and tensile strength was found. The material from one producer consistently displayed a limited amount of plastic elongation at room temperature. Author

N64-13768 Marquardt Corp., Van Nuys, Calif.
MECHANICAL PROPERTIES OF WROUGHT TUNGSTEN, VOLUME II Technical Documentary Report [Apr. 1962–Apr. 1963]
C. A. Drury, R. C. Kay, A. Bennett, and M. J. Albom Wright-Patterson AFB, Ohio, AF Mater. Lab., Nov. 1963 116 p refs
(Contract AF 33(616)-7385)
(ASD-TDR-63-585, Vol. 2; AD-427128)

Tensile and creep properties to 5000° F were determined for wrought unalloyed tungsten sheet in order to establish design criteria. Three lots of material, prepared in accordance to the same specification, were used. Hardness and tensile values below 2500° F could be correlated for entire lots of material. Correlation was found at strain rate and hold time versus tensile strength properties or elongation values, at certain temperatures. Properties varied with powder lot to such an extent as to affect design parameters. Author

N64-13817 Ling-Temco-Vought, Inc., Dallas, Tex. Vought Aeronautics Div.
LOW CYCLE FATIGUE DESIGN DATA ON MATERIALS IN A MULTI-AXIAL STRESS FIELD [Final Report, Apr. 1962–Sep. 1963]
S. W. Mc Claren and J. H. Best Wright-Patterson AFB, Ohio, AF Mater. Lab., Nov. 1963 186 p refs
(Contract AF 33(657)-8525)
(RTD-TDR-63-4094; AD-426360)

The biaxial characteristics of a leading group of aerospace materials have been evaluated under static and fatigue conditions. The relationship between uniaxial and biaxial properties of materials is presented for static loading and low-cycle repeated-load applications. This study included basic notch toughness tests, and the resulting data have been combined with rating parameters of biaxial ductility, biaxial strength–weight ratios, and biaxial fatigue life to establish a relative ranking of the program materials. Fracture analysis studies were conducted to develop relationships between the type of fracture that occurred and the state of stress. Manufacturing techniques for shear-spinning of this group of materials are presented in detail. Included are data on shear-formed 6AL-4V titanium pressure vessels which brought about a significant improvement of the state-of-the-art in this area. Author

N64-13832 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE ENGINEERING PROPERTIES OF TANTALUM AND TANTALUM ALLOYS
F. F. Schmidt and H. R. Ogden 13 Sep. 1963 114 p refs
(Contract AF 33(616)-7747)
(DMIC-189; AD-426344)

Results of a state-of-the-art survey covering tantalum and seven of its alloys are presented. All data are given in tabular and graphical form, covering some of the more important physical, mechanical, and metallurgical properties for each material. Author

N64-13839 Battelle Memorial Inst., Columbus, Ohio
THE ENGINEERING PROPERTIES OF TUNGSTEN AND TUNGSTEN ALLOYS
F. F. Schmidt and H. R. Ogden 27 Sep. 1963 138 p refs
(Contract AF 33(616)-7747)
(DMIC-191; AD-425547)

This report presents the results of a state-of-the-art survey covering tungsten and ten of its alloys. All data are given in tabular and graphical form covering some of the more important physical, mechanical, and metallurgical properties for each material. References are given at the conclusion of each material section. Author

N64-13845 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
TUNGSTEN RESEARCH AND DEVELOPMENT REVIEW 1960–1962

J. L. Ratliff, W. A. Gibeaut, and H. R. Ogden 23 Oct. 1963 52 p refs
(DMIC 193; AD-425474)

This report presents a technical summary of the overall research and development efforts on tungsten. It is divided into separate categories of more specific emphasis according to technology. Included for each area of technology is a brief statement of research objectives, a few significant details concerning the approach of the programs, and a short summary of any important developments or conclusions. Author

N64-13851 Franklin Inst., Philadelphia, Pa.
DISTILLATION OF BERYLLIUM BY SUBLIMATION AND EVAPORATION Interim Report, 15 Aug.-30 Nov. 1963
G. London and M. Herman [1963] 13 p refs
(Contract AF 33(657)-11233)
(I-B2122-1; AD-426539)

A modified technique for melting beryllium is discussed. This technique is essentially an adaptation of a cold crucible or "skull" melting technique used extensively for the melting of reactive metals. The modification makes it amenable for use on the small, sealed-type apparatus considered necessary for the distillation study. A slug of Brush beryllium, supported by a water-cooled copper-pedestal, is melted by external induction power. The upper portion of the slug melts while the cooled base remains solid, thus stabilizing the melting operation. The water-cooled copper-pedestal melting equipment is being used for the collection and analysis of vacuum-deposited beryllium metal under a variety of operating equipment. In addition, it was decided that the final distillation studies will be conducted with Pechiney SR material after the bulk of the oxides has been removed by passing two floating zone passes through the material. I.v.L.

N64-13853 Wien U. (Austria) Physikalisches Inst.
INVESTIGATION OF THE EFFECTS OF ULTRASONICS ON THE DEFORMATION CHARACTERISTICS OF METALS Interim Report No. 3, 1 Aug.-31 Oct. 1963
[1963] 13 p refs
(Contract N-62558-3436)
(AD-425846)

Experiments concerning the hardening and softening effects of ultrasonic treatment have been extended. Formerly only zinc crystals served as the test material, but now single crystal aluminum and polycrystalline materials are also included. The effects of superimposed ultrasonics in static tensile tests are described. The significance of ultrasonic treatment in the recovery of aluminum from deformation is under investigation. Experiments to determine the importance of ultrasonics in the recrystallization of commercial zinc have been continued with the irradiation now being carried out prior to annealing. The importance of ultrasonic treatment for age hardening was examined with an AlCuMg alloy. In this case the ultrasonic treatment was carried out at the beginning, as well as during, the entire annealing treatment. Author

N64-13867 Aerojet-General Corp., Azusa, Calif.
STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS Tenth Quarterly Progress Report, 1 Jul.-30 Sep. 1963
R. B. Setterlund Oct. 1963 14 p
(Contract DA-04-495-ORD-3069)
(Rept. 0414-02-1; AD-422105)

A chemical analysis was made of the four heats of 18% nickel maraging steel to be studied in the investigation of the effect of compositional variation on the stress-corrosion characteristic of this steel. The chemical analysis of the low-alloy martensitic steel and the die steel to be studied in order to show the effect of environmental temperature on the rate of stress-corrosion cracking, is also included. R.T.K.

N64-13868 Southern Research Inst., Birmingham, Ala.
DEVELOPMENT OF HIGH STRENGTH AND FRACTURE TOUGHNESS IN STEELS THROUGH STRAIN-INDUCED TRANSFORMATIONS Summary Technical Report, 2 Jul. 1962-30 Jun. 1963
J. D. Morrison, M. A. Campbell, and J. R. Kattus 5 Sep. 1963 94 p refs
(Contract DA-01-009-ORD-1070)
(WALTR-323.4/2-3; AD-421738)

An investigation was made to determine the effects of variations in alloy content, cold-working temperature, and amount of cold work on the tensile and toughness properties of metastable austenitic stainless steels. The purpose of this program was to arrive at an alloy composition and processing procedure that result in an optimum combination of strength and toughness in a structural sheet material that can be used in the fabrication of highly stressed structures, such as rocket motor casings. It was found that the optimum combination of high yield strength and fracture toughness is obtained by cold-working alloys containing about 0.04% to 0.05% carbon. An alloy containing 0.055% C, 0.35% Si, 0.48% Mn, 15.3% Cr, and 6.4% Ni developed, as a result of 20% deformation at 80° F, a yield strength of 250,000 psi and a K_c of 190,000 psi √in. or greater at test temperatures down to −200° F. Another alloy containing 0.048% C, 0.83% Si, 0.24% Mn, 15.8% Cr, and 7.8% Ni developed, as a result of 20% deformation at −320° F, a yield strength of 280,000 psi and a K_c of 190,000 psi √in. or greater at test temperatures down to −200° F.
Author

N64-13894 Arde-Portland, Inc., Paramus, N.J.
DEVELOPMENT OF HIGH-STRENGTH ALLOYS BY CRYOGENIC STRETCH-FORMING Quarterly Technical Report No. 2, 10 Jul. 1963-9 Oct. 1963
Martin S. Miller [1963] 28 p
(Contract NOw-63-0387-c)
(AD-422933)

The computer program has developed new expressions for room-temperature aged and unaged true ultimate tensile strengths (TUTS). The analysis on cryogenic tensile-strength predictions was less successful. Chemical analyses of heats under study include computer-optimized chemistries, Cb-Al additions, Co-Mo additions, air-melted material, and vacuum-melted material. Tensile test data reveal significant modification in strengths and ductility by Cb-Al or Co-Mo additions. The Cb-Al heat displayed high aging response in addition to high strain response, reaching a room-temperature TUTS of 350,000 psi after aging. Vacuum-melted heats show a reduced response to aging as compared to air-melted material. It appears that factors, such as phosphorus, sulfur, and gas content, have a major effect on age response. Author

N64-13897 IIT Research Inst., Chicago, Ill.
FRACTURE OF METALS Interim Report, 22 Mar.-22 Jun. 1963
W. Rostoker and H. Nichols 2 Jul. 1963 18 p refs
(Contract DA-11-ORD-022-3108)
(ARF-B183-13; AD-298690)

Studies are in progress toward understanding the mechanism of delayed failure in the presence of low-melting liquid metals. Experiments utilize age-hardened beryllium copper wetted with mercury. During the time-delay period between application

of sustained stress to wetted samples and the occurrence of failure, cracks can only be detected during the last minute or a fraction thereof. During the long, preceding period mercury diffuses into the surface, developing a state of what is equivalent to surface age hardening. Author

N64-13900 Phillips Petroleum Co., Idaho Falls, Idaho
MATERIALS TESTING REACTOR-ENGINEERING TEST REACTOR TECHNICAL BRANCHES Quarterly Report, 1 Apr.-30 Jun. 1963
J. R. Huffman, D. R. de Boisblanc, L. A. Schmittroth, and R. G. Fluharty 18 Nov. 1963 51 p refs
(Contract AT(10-1)-205)
(IDO-16917) OTS: $1.25

Distortion and cracking of portions of the MTR beryllium reflector are reported. Preliminary metallurgical and gas analyses on fracture chips indicate that some of the fractures may have occurred at exposures much lower than 10^{22} nvt (>1 Mev). The resonance integrals of mixtures of gold and indium oxide as calculated by a modified ZUT code were compared with the integrals calculated with the RBU Monte Carlo program. Although there were some discrepancies between the results of the two methods, both methods showed some interaction between the prominent gold and indium resonances. Statistical techniques were employed to determine those angles and relative frequencies of measurements which will, for a given total number of observations, give the smallest variances for the directional-correlation coefficients in correlation functions which contain $P_6(\cos\theta)$ and $P_8(\cos\theta)$ terms. Author

N64-13908 Atomic Energy Commission, Washington, D.C. Div. of Technical Information
THE STRUCTURE OF ALLOYS OF CERTAIN SYSTEMS CONTAINING URANIUM AND THORIUM
E. M. Potapova, ed. [Jul. 1963] 476 p refs Transl. into ENGLISH by JPRS of book "Stroenie Splavov Nekotornykh Sistem s Uranom i Toriem" Moscow, State Publ. House of Lit. in the Field of Atomic Sci. and Technol., 1961
(AEC-TR-5834) OTS: $6.00

CONTENTS:

1. INVESTIGATION OF ALLOYS OF THE URANIUM-ZIRCONIUM SYSTEM O. S. Ivanov and G. N. Bagrov p 3-17 refs

2. PHASE DIAGRAM AND STRUCTURE OF ALLOYS OF THE URANIUM-NIOBIUM SYSTEM O. S. Ivanov and G. I. Terekhov p 18-32 refs

3. DECOMPOSITION OF THE Y-SOLID SOLUTION OF URANIUM AND NIOBIUM O. S. Ivanov and Y. S. Virgil'ev p 33-44 refs

4. A STUDY OF THE STRUCTURE OF THE URANIUM-MOLYBDENUM SYSTEM AT 600-1200° AND THE PROPERTIES OF ITS ALLOYS O. S. Ivanov, T. A. Badaeva, A. T. Semenchenkov and R. I. Kuznetsova p 45-62 refs

5. A STUDY OF THE STRUCTURE OF THE URANIUM-MOLYBDENUM SYSTEM AT TEMPERATURES BELOW 600° AND OF THE PHASE DIAGRAM OF THE SYSTEM O. S. Ivanov, A. T. Semenchenkov and N. I. Kozlova p 63-79 refs

6. TRANSFORMATION OF THE Y-SOLID SOLUTION IN DOUBLE ALLOYS OF URANIUM AND MOLYBDENUM O. S. Ivanov and Y. S. Virgil'ev p 80-84 refs

7. PHASE DIAGRAM OF URANIUM-ZIRCONIUM-NIOBIUM. RADIAL SECTIONS OF THE SYSTEM O. S. Ivanov and L. I. Gomozov p 85-97 refs

8. PHASE DIAGRAM OF URANIUM-ZIRCONIUM-NIOBIUM. SECTIONS WITH CONSTANT URANIUM CONTENT AND THE POLYTHERMAL DIAGRAM OF THE SYSTEM O. S. Ivanov and L. I. Gomozov p 98-117 refs

9. THE BEHAVIOR OF ALLOYS OF THE URANIUM-ZIRCONIUM-NIOBIUM SYSTEM DURING QUENCHING AND TEMPERING L. I. Gomozov and O. S. Ivanov p 118-130 refs

10. ISOTHERMAL CROSS SECTIONS OF THE TRIPLE SYSTEM URANIUM-MOLYBDENUM-ZIRCONIUM AT 1000-625° O. S. Ivanov and G. N. Bagrov p 131-153 refs

11. ISOTHERMAL CROSS SECTIONS AT 600, 575, and 500°, POLYTHERMAL SECTIONS, AND THE PHASE DIAGRAM OF THE TRIPLE SYSTEM URANIUM-MOLYBDENUM-ZIRCONIUM O. S. Ivanov and G. N. Bagrov p 154-176 refs

12. BEHAVIOR OF THE Y-SOLID SOLUTION OF THE URANIUM-MOLYBDENUM-ZIRCONIUM SYSTEM DURING QUENCHING AND TEMPERING O. S. Ivanov and G. N. Bagrov p 117-184 refs

13. POLYTHERMAL CROSS SECTIONS OF THE PHASE DIAGRAM OF THE SYSTEM URANIUM-NIOBIUM-MOLYBDENUM O. S. Ivanov and G. I. Terekhov p 185-199 refs

14. ISOTHERMAL CROSS SECTIONS FOR 560, 500° AND THE PHASE DIAGRAM OF THE TRIPLE SYSTEM URANIUM-NIOBIUM-MOLYBDENUM O. S. Ivanov and G. I. Terekhov p 200-212 refs

15. ISOTHERMAL CROSS SECTIONS FOR 1200-575° AND PHASE DIAGRAMS OF THE URANIUM-NIOBIUM-MOLYBDENUM SYSTEM O. S. Ivanov and G. I. Terekhov p 213-231

16. TRANSFORMATIONS OF THE Y-SOLID SOLUTION DURING QUENCHING AND TEMPERING IN THE URANIUM-NIOBIUM AND URANIUM-NIOBIUM-MOLYBDENUM SYSTEMS O. S. Ivanov and G. I. Terekhov p 232-247 refs

17. STRUCTURE OF QUATERNARY ALLOYS OF THE URANIUM-ZIRCONIUM-NIOBIUM-MOLYBDENUM SYSTEM AT 1000 AND 800° O. S. Ivanov and Y. S. Virgil'ev p 248-277 refs

18. INVESTIGATION OF THE STABILITY OF THE Y-SOLID SOLUTION, FIXED BY QUENCHING, IN ALLOYS OF URANIUM-ZIRCONIUM-NIOBIUM-MOLYBDENUM DURING PROLONGED TEMPERING AT 430-550° O. S. Ivanov and Y. S. Virgil'ev p 278-288 refs

19. NONMETALLIC INCLUSIONS IN ALLOYS OF URANIUM WITH ZIRCONIUM, NIOBIUM, AND MOLYBDENUM Y. S. Virgil'ev p 289-293 refs

20. STRUCTURE OF URANIUM-ZIRCONIUM-TITANIUM ALLOYS A. T. Semenchenkov and O. S. Ivanov p 294-306 refs

21. PHASE DIAGRAM OF THE URANIUM-MOLYBDENUM-CHROMIUM SYSTEM T. A. Badaeva and R. I. Kuznetsova p 307-320 refs

22. PHASE DIAGRAMS OF SYSTEMS WITH THORIUM T. A. Badaeva p 321-336 refs

23. STRUCTURE OF THORIUM-BERYLLIUM ALLOYS T. A. Badaeva and R. I. Kuznetsova p 337-347 refs

24. PHASE DIAGRAM OF THE THORIUM-ZIRCONIUM SYSTEM T. A. Badaeva and G. K. Alekseenko p 348-360 refs

25. STRUCTURE OF ALLOYS OF THE THORIUM-CERIUM SYSTEM T. A. Badaeva and R. I. Kuznetsova p 361-366 refs

26. DETERMINATION OF THE SOLUBILITY OF LEAD AND TIN IN THORIUM IN THE SOLID STATE T. A. Badaeva and R. I. Kuznetsova p 367-375 refs

27. STRUCTURE OF ALLOYS OF THE THORIUM-ZIRCONIUM-URANIUM SYSTEM T. A. Badaeva and G. K. Alekseenko p 376-394 refs

28. JOINT SOLUBILITY OF THORIUM AND URANIUM IN LIQUID BISMUTH T. A. Badaeva and L. I. Rybakova p 395-402 refs

29. STRUCTURE OF ALLOYS OF $ThBe_{13}$-UBe_{13} T. A. Badaeva and R. I. Kuznetsova p 403-408 refs

30. INVESTIGATION OF THE THORIUM-URANIUM MONOCARBIDE SYSTEM O. S. Ivanov and Z. M. Alekseeva p 409–418 refs

31. INVESTIGATION OF THE STRUCTURE OF ALLOYS OF THE SYSTEMS UC-ZrC, UC-ThC, AND ThC-ZrC O. S. Ivanov and Z. M. Alekseeva p 419–429 refs

32. INVESTIGATION OF ALLOYS OF THE TRIPLE SYSTEM UC-ThC-ZrC O. S. Ivanov and Z. M. Alekseeva p 430–436 refs

33. STRUCTURE OF ALLOYS OF THORIUM OXIDE WITH ZIRCONIUM OXIDE N. M. Voronov, A. S. Danilin and I. T. Kovalev p 437–446 refs

34. PHASE DIAGRAM OF THE URANIUM DIOXIDE-ZIRCONIUM OXIDE SYSTEM N. M. Voronov, E. A. Voitekhova, and I. T. Kovalev p 447–461 refs

35. REACTION OF URANIUM DIOXIDE WITH BARIUM OXIDE N. M. Voronov and R. M. Sofronova p 462–469 refs

N64-13954 IIT Research Inst., Chicago, Ill. Technology Center

DISPERSION-STRENGTHENED VANADIUM ALLOYS Final Report, 14 Dec. 1962-13 Dec. 1963

10 Jan. 1964 35 p

(Contract N600(19)59567)

(IITRI-B6007-6; AD-427343)

Vanadium–columbium base alloys containing additions of titanium, zirconium, or hafnium in combination with up to 0.2w/o carbon were prepared by arc-melting and fabricated to sheet for elevated temperature creep tests. Compositions based on V-60Cb and containing titanium or zirconium with carbon had good fabricability, but V-60Cb-1Hf-C and V-40Cb-30Ta-C alloys were difficult to work. Creep tests conducted on siliconized specimens in 2000° F air showed that large carbon additions (0.1 and 0.2w/o) produced increased creep rates in V-60Cb base alloys. The most creep-resistant composition was W-60Cb-10Ta-1Zr-0.075C. A series of powder metallurgy alloys based on V-60Cb-1Ti and containing oxide or carbide dispersants were prepared to evaluate the compatibility of various dispersants with the vanadium–columbium alloy matrix. On the basis of microhardness tests of the alloy matrix, hafnium and zirconium carbides appeared to be the most stable at 2400° F. Author

N64-13970 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center

THE EFFECT OF FABRICATION HISTORY AND MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF REFRACTORY METALS AND ALLOYS

A. G. Imgram and H. R. Ogden 10 Jul. 1963 71 p refs

(DMIC 186; AD-423952)

Factors such as grain size and shape, second-phase distribution, and impurity content and location are considered. The characteristic behavior of dispersion- and solid-strengthened alloys is also discussed. Author

N64-13973 Franklin Inst., Philadelphia, Pa. Labs. for Research and Development

PREPARATION AND EVALUATION OF HIGH PURITY BERYLLIUM Quarterly Progress Report, 15 Jul.-14 Oct. 1963

G. E. Spangler, M. Herman, D. B. Hoover, and V. V. Damiano [1963] 35 p refs

(Contract NOw63-0500-d)

(Q-82089-3; AD-423517)

The purpose of this investigation is to produce high-purity beryllium and to study its deformation and fracture characteristics. The recovery, recrystallization, and grain growth characteristics of hot-swaged zone-refined beryllium, as well as those of hot-swaged SR-grade Pechiney and commercial-grade Berylco beryllium, have been studied. Simple bend tests of heat-treated zone-refined hot-swaged wire exhibited considerable ductility at grain sizes of 60 to 80 microns. Author

N64-13974 Franklin Inst., Philadelphia, Pa. Labs. for Research and Development

EFFECTS OF THERMO-MECHANICAL VARIABLES ON THE TEXTURE AND BEND DUCTILITY OF HIGH PURITY BERYLLIUM SHEET Interim Report, 15 Jul.-15 Dec. 1963

Marvin Herman [1963] 11 p

(Contract AF 33(657)-11234)

(I-B2106-1; AD-426848)

The present status of an investigation to determine the effects on beryllium-sheet properties (texture, bend, ductility, and strength) of the use of high-purity material and deformation procedures that minimize basal plane texturing is discussed. P.V.E.

N64-14000 Army Materials Research Agency, Watertown, Mass. Materials Engineering Lab.

PRELIMINARY REPORT ON THE BIAXIAL TENSILE BEHAVIOR OF ANISOTROPIC SHEET MATERIALS

Joseph L. Sliney, Donald A. Corrigan, and Frederick Schmid Aug. 1963 32 p refs

(AMRA-TR-63-11; AD-421815)

This report deals with the influence of a biaxial stress field on the strength of anisotropic sheet materials. An analytical and mechanistic treatment of the problem is presented with experimental data on two commercial titanium-base alloy sheet materials. In addition, two closed-end cylindrical pressure vessels were fabricated and hydrostatically tested. Tensile strength increases of 50 percent and greater were obtained under plane, strain, biaxial, tensile loading conditions. Author

N64-14052 Aeronautical Research Labs., Melbourne (Australia)

PRELIMINARY OBSERVATIONS OF THE EFFECTS OF SILVER ADDITIONS ON THE WELDING OF ALUMINIUM/MAGNESIUM ALLOYS

J. T. Vietz Melbourne, Dept. of Supply, Jul. 1963 17 p refs

(ARL/Met. 18)

Previous work has shown that small additions of silver (0.5 wt.%) cause some aluminum–magnesium alloys to respond to heat treatment with marked improvements in mechanical properties. This investigation has been extended on a small scale to examine the possible restoration of properties in the heat-affected zones of welded aluminum–5% magnesium alloys. Both silver-free and silver-containing welded plate were examined in a variety of heat-treated conditions. Quite significant improvements in the strength of the welded joints were obtained if some form of postweld aging treatment was given. Salt spray tests did show, however, that aging treatments tended to reduce corrosion resistance. Author

N64-14140 Aeronutronic, Newport Beach, Calif.

INTERNAL ENVIRONMENT OF SOLID ROCKET NOZZLES Second Quarterly Technical Report, 1 Sep.-30 Nov. 1963

F. C. Price, W. C. Kuby, R. A. Dobbins, and V. A. Marple 19 Dec. 1963 61 p refs

(Contract AF 04(611)-9072)

(RTD-TDR-63-1075; U-2414; AD-428116) OTS: $6.60

This report describes the hardware buildup and schedule of heat flux tests on a molybdenum nozzle with hydrogen, oxygen, water, and varying amounts of alumina. Cold flow

technique development has shown interesting particle impingement effects as a function of modeling system design and nozzle shape. The implied full-scale particle impingement rates are listed for the first two cases studied. A complete report is given on a program studying radiation of a hydrogen–oxygen–alumina plume from a 1-in. diam. throatless engine. High emissivity values are indicated for all but the smallest engines. Author

N64-14160 Battelle Memorial Inst., Columbus, Ohio
PRODUCTION URANIUM RESIDUAL STRESSES, INTERNAL FRICTION, AND MODULUS
Ellis L. Foster, ed. 27 Dec. 1963 41 p refs
(BMI-1658) OTS: $1.00

Distinct differences in residual stresses were noted between oil- and water-quenched specimens, those in the latter being in the 60,000-psi range while oil-quenched specimens showed about one-fifth of this stress. In the final production step, the canning procedure, however, the effects of earlier stressing are almost completely canceled, final stresses being in the 15,000-to 20,000-psi range. In measurements after various mechanical and thermal treatments, internal friction and Young's modulus went through a maximum and minimum, respectively, with increasing severity of quenching from a beta temperature. Heat-treated and furnace-cooled uranium beta, when cold reduced, exhibited monatomic increases and decreases, respectively, in internal friction and modulus for reductions up to 12 percent. Uranium which was hot forged and rolled and then cold reduced in increments up to 46 percent in area showed a rapid reduction in modulus with increasing degree of cold work, which then leveled off; the internal friction fluctuated, showing no relationship to degree of working. Author

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-13600 Bendix Corp., South Bend, Ind.
STRENGTHENING OF CHROMIUM-MAGNESIA COMPOSITES Final Report, 29 Jan.–31 Oct. 1963
G. C. Reed Nov. 1963 72 p refs
(Contract N600(19)59647)
(AD-424854)

The program was initiated with a determination of the notched tensile properties of Chrome-30. This chromium base material contains 6% MgO and 0.5% Ti and was considered representative of typical production material at the time this study was begun. Several notch configurations, strain rates,and speciment heat treatments were included in this investigation. The primary purpose of this program was to investigate alloy strengthening of chromium composites while maintaining usable ductility. The compositional variables studied included changes in MgO content and substitution of other oxides for MgO. The processing changes examined for this purpose were directed toward reducing the oxide phase particle size and improving dispersion. Best results were obtained with a composite consisting of Cr + 2% MgO. This material exhibited an average room temperature tensile elongation of over 50%. This was more than twice the elongation obtained with Chrome-30. The ductile-to-brittle transition temperature of the Cr + 2% MgO material was found to be 35° F. Thermogravimetric oxidation studies indicated that oxidation–nitridation rates were independent of MgO content in the range 0%–5%. Author

N64-13602 Battelle Memorial Inst., Columbus, Ohio
HIGH-VOLTAGE BREAKDOWN IN VACUUM AND IN OIL Technical Summary Report
L. H. Bettenhausen 10 Oct. 1962 27 p refs
(ARPA-SD-80; ARPA Order 197)
(BMI-197-12-1; AD-294022)

The literature available on high-voltage breakdown in vacuum and in oil is surveyed, with emphasis being placed on the application of this information to high-power vacuum tubes. The nature of the breakdown phenomena in vacuum is discussed first. Current research into vacuum breakdown is then considered. A description of the breakdown phenomena in liquid dielectrics is presented, with emphasis on the behavior of insulating oils. C.L.W.

N64-13607 Armour Research Foundation, Chicago, Ill.
GLASS FIBER STRENGTH ENHANCEMENT THROUGH BUNDLE DRAWING OPERATIONS Second Quarterly Progress Report [Sep. 7–Dec. 7, 1962]
R. H. Cornish, comp [1962] 25 p refs
(Contract N600(19)-58450)
(ARF-K263; AD-296050)

Progress is reported as follows: (1) A single-filament tensile tester was fabricated for use in determining the existence of, or limitation on, the size effect in the strength of glass fibers. (2) Wetting–dewetting studies were continued on the doped brazed alloys and doped 80Pb-20In, using both pure Ti or Zr and a combination thereof. (3) Metallizing techniques were extended to drawing of precoated rods, both with and without glass sheaths, to produce metallized fibers; improvement and modification of the apparatus for coating as-drawn fibers were completed. (4) Bundle-drawing investigations were centered about drawing of the simplest combinations of glass rods in a metal matrix contained in sheath; the basic feasibility of glass wetted with metal for redrawing operations was established. R.T.K.

N64-13699 Joint Publications Research Service, Washington, D.C.
WETTABILITY OF NbC-VC AND NbC-TiC ALLOYS WITH NICKEL
V. I. Tumanov, V. F. Funke, and L. I. Belen'kaya *In its* Transl. from Poroshkovaya Met. [Kiev, v. 3] No. 5, 1963 8 Jan. 1964 p 10–14 refs (See N64-13697 05-01) OTS: $0.75

An investigation of the wettability of alloys of binary carbides in the IV and V groups of the periodic system was conducted. Samples of NbC-VC, containing 0.28%, 52%, and 100% VC (mol percent), and NbC-TiC, containing 16%, 32%, 44%, 55%, 74%, 87%, and 100% TiC, were investigated. A relationship describing the change of the contact wetting angle of nickel on solid surfaces of NbC-VC and NbC-TiC alloys was obtained. R.T.K.

N64-13828 Naval Ordnance Lab., White Oak, Md.
ELECTRICAL RESISTIVITY OF A POLYVINYL CHLORIDE-DIBUTYL PHTHALATE PLASTISOL
R. W. Warfield and A. H. Rosen 23 Jul. 1963 15 p 30 refs
(NOLTR-63-250; AD-426954)

Resistivity measurements can be employed to follow the hardening of plastisol systems and yield information useful in elucidating the nature of the hardening process. This process appears to occur in two stages. In order to obtain the maximum extent of hardening, it is necessary to conduct the final

stage in the hardening process at a temperature above the glass transition temperature of the polymeric component. Plasticized systems exhibit a nonlinear dependence of resistivity vs temperature. For a number of plasticized polymers, a linear relationship is found to exist between the logarithm of the magnitude of the resistivity at 25° C and the activation energy for the electrical conduction process. This relationship is discussed, and a possible explanation of its significance is given. Author

N64-13850 Army Materials Research Agency, Watertown, Mass.
ANALYSIS OF A REFRACTORY COATING SYSTEM FOR THE THERMAL PROTECTION OF TITANIUM
Raymond L. Farrow and Milton Levy Sep. 1963 25 p refs
(AMRA-TR-63-13; AD-421816) OTS: $0.75

Metallic and ceramic refractory coatings are being considered to extend the useful life of titanium under conditions of high temperatures and erosive atmospheres. The effects of the refractory composite system of flame-sprayed nickel chrome, aluminum oxide, and copper, on the thermal characteristics of a titanium tube were investigated. The refractory composite system was examined metallographically for adhesion of coating to coating, and coating to substrate, porosity of coatings, and effect of deposition on the structure of the titanium substrate. A comparison of the weights of the composite titanium tube system and a similar size steel tube was made. A weight reduction of 19 percent is effected by the use of the coated titanium system. The advantages and disadvantages of each coating are discussed, and suggestions for future work are presented. Author

N64-13860 Carborundum Co., Niagara Falls, N.Y.
A STUDY OF FUNDAMENTAL MECHANICAL PROPERTIES OF CERAMIC SINGLE CRYSTALS Fifth Bi-Monthly Progress Report, Sep. 15- Nov. 14, 1963
R. S. Liebling 27 Nov. 1963 7 p refs
(Contract N600(19)-59749)
(AD-427371)

Load capacity of bar-shaped silicon carbide single crystals varies inversely with the length–width ratio and boron concentration. As thickness increases, load capacity increases. The effects of temperature, thickness, length, width, boron concentration, and surface treatment are being thoroughly analyzed, using data-processing equipment. Author

N64-13899 Phillips Petroleum Co., Bartlesville, Okla. Research and Development Dept.
ORGANIC COOLANT RESEARCH SUMMARY REPORT, JULY 1, 1960-MARCH 31, 1963
J. C. Hillyer 1 Oct. 1963 74 p refs
(Contract AT(10-1)-1080)
(IDO-16911) OTS: $1.75

Summaries are presented of research activities in the following areas: (1) fundamental studies of radiolysis—research into radiolysis of terphenyls and of all organic molecules at elevated temperatures, in order to learn in detail the nature of the products of irradiation of various polyphenyl molecules, so that the mechanism of the radiolysis and the process by which radiation damage is initiated in such coolants could be evolved; (2) stable coolant structures—development of coolants whose molecular structures are very stable when subjected to radiolysis at elevated temperatures and will exceed those of currently used terphenyls; (3) stabilization against radiolysis—development of effective stabilizers to be added to organic coolants; (4) heat-transfer surface fouling—development of experimental equipment and techniques for evaluating the significant variables in film formation, using these techniques to evaluate various hypotheses of film formation, and development and testing of means of preventing or minimizing film formation; (5) low-cost coolants—reduction of inventory and replacement cost for organic coolants; and (6) reclamation of coolants—development of an economical method of reconstituting a damaged coolant into a usable coolant. P.V.E.

N64-13927 National Bureau of Standards, Boulder, Colo. Cryogenic Engineering Lab.
THERMODYNAMIC PROPERTIES OF CRYOGENIC FLUIDS
R. B. Stewart and K. D. Timmerhaus (Colo. U.) 1963 33 p Presented at 1963 Cryog. Eng. Conf., Colorado U., Boulder, 12–21 Aug. 1963 Submitted for Publication
(NASA Order R-45)
(NASA CR-55330; NBS Paper A-3; R-295) OTS: $3.60 ph, $1.19 mf

This paper reviews briefly the availability of cryogenic data for several fluids, describes the evaluation and compilation programs that have produced new property tables for these fluids, and indicates the needs for new measurements. In describing the results of these compilation efforts, methods for utilizing the computer for thermodynamic data analysis are also suggested. Author

N64-13943* General Electric Co., Philadelphia
THE ELASTIC MODULI OF FIBER-REINFORCED MATERIALS
Zvi Hashin (Pa. U.) and B. Walter Rosen Repr. from J. Appl. Mech., 1963 p 1–10 refs Presented at the Am. Soc. of Mech. Engr. Winter Ann. Meeting, Philadelphia, 17–22 Nov. 1963
(NASA Contract NASw-470; Contract NOw-61-0613-D)
(ASME Paper 63-WA-175)

Bounds and expressions for the effective elastic moduli of materials reinforced by parallel, hollow, circular fibers have been derived by a variational method. Exact results have been obtained for hexagonal arrays of identical fibers, and approximate results were obtained for random arrays of fibers, which may have unequal cross sections. Typical numerical results have been established for technically important elastic moduli. Author

N64-13952 Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
DIELECTRIC MATERIALS FOR HIGH TEMPERATURE APPLICATION Report Period: 15 Feb.-14 May 1963
Joseph Green, Nathan Mayes, and Richard Crooker [1963] 30 p refs
(Contract NObS-88318)
(RMD-5026-Q1; AD-338257) (Declassified)

Research was conducted toward the preparation of thermally stable carborane-silicone materials for use as embedding compounds and elastomers. Two new carborane-silicone intermediates and the polymers prepared from them are reported. Curing studies were conducted, including the preparation of polymers with functional curing sites. Isolation of a carborane cyclotetrasiloxane is reported, and work was conducted toward the preparation of cyclotetrasiloxanes and cyclotrisiloxanes for use as intermediates in the preparation of high-molecular-weight carborane silicones by ring opening methods. Author

N64-13957 Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
ZINC SULFIDE Data Sheets
M. Neuberger and D. L. Grigsby Dec. 1963 77 p refs
(DS-135; AD-427288)

The Electronic Properties Information Center has been established to collect, index, and abstract the literature on the electrical and electronic properties of materials and to evaluate and compile the experimental data from that literature. A modified coordinate index to the literature is machine stored and printed for manual use. The center publishes data sheets, summary reports, thesauri, glossaries, and similar publications as sufficient information is evaluated and compiled. This report consists of the compiled data sheets on zinc sulfide. Author

N64-13963 Illinois U., Urbana
PHYSICS OF THE SOLID STATE: THE HIGH TEMPERATURE DIELECTRIC CONSTANT OF POTASSIUM BROMIDE Technical Report No. 7
P. V. Sastry Dec. 1963 14 p refs
(Contract Nonr-1834(19))
(AD-426658)

The high-temperature dielectric constant of potassium bromide was found to possess a dispersion in the frequency region between one to ten megacycles that is similar to that exhibited by potassium chloride. As in the case of potassium chloride, an attempt to interpret the dispersion in terms of the dipole moments of vacancy pairs led to an implausibly large concentration of pairs that was approximately fifty times greater than expected. The absence of theoretical calculations for potassium bromide prevented the comparison of theory and experiment as was possible in the case of potassium chloride. R.T.K.

N64-13978 Hanford Atomic Products Operation, Richland, Wash.
HIGH TEMPERATURE, SHORT-TIME, URANIUM CARBIDE-METAL REACTIONS
J. A. Christensen 9 Jan. 1964 20 p refs
(Contract AT(45-1)-1350)
(HW-72031) OTS: $0.50

Relative compatibility of uranium monocarbide with nine different alloys was evaluated at temperatures between 1000° and 2400° C by tests of 10 min or less duration. Author

N64-13998 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS Fourth Quarterly Report, 1 Apr.-30 June 1963
Willard H. Sutton Watertown, Mass., Army Mater. Res. Agency, Jun. 1963 29 p refs
(Contract DA-36-034-ORD-3768RD)
(AMRA-CR-63-01/4; AD-421909)

Sessile drop experiments were conducted on Ni, Ni-Ti, and Ni-Cr compositions and α -Al_2O_3 single crystal plaques. Pure nickel drops reached equilibrium within 5 to 15 min after melting. In all cases, addition of Ti and Cr significantly decreased contact angles. To evaluate adhesion between solidified drops and α-Al_2O_3 plaques, shear tests were conducted. Fracture always occurred in the plaque, and examination of the interfacial region showed shear tests were unable to separate completely α-Al_2O_3 from Ni. Greatest shear strength measured was 15,000 psi. Addition of Ti and Cr contributed significantly to the wetting of the Ni to α-Al_2O_3. Author

N64-14007 IIT Research Inst., Chicago Ill. Technology Center
HIGH-TEMPERATURE OXIDATION PROTECTIVE COATINGS FOR VANADIUM-BASE ALLOYS [First] Bimonthly Report, 1 Oct.-30 Nov. 1963
Larry I. Kane et al 2 Jan. 1964 10 p
(Contract NOw-64-0140-c; Contract N600(19)59567; Contract NOw62-0101-c)
(IITRI-B6019-1; AD-426040)

Primary experimental effort was directed to determining the influence of the silicon coating process on the ductile-to-brittle transition behavior of coated V-60Nb-1Ti sheet. Eleven tensile samples of this sheet were coated in two separate pack runs under similar conditions. Several of these were tested at 32° F, 140° F, and at room temperature, in the as-coated condition. In addition, specimens were vacuum annealed and oxidized after coating and subsequently tested at room temperature. All tensile tests were performed at a strain rate of 0.07 in./in./min. Brittle failure occurs at both 32° F and at room temperature for specimens tested in the as-coated condition. At 140° F the material is ductile, having tensile properties. Thus it appears that for tensile testing, a brittle-to-ductile transition occurs at just above room temperature. The specimens which were vacuum annealed for 2000° F for 5 hours and then tested at room temperature were brittle, but their average tensile strength of 124,000 psi was considerably higher than that of the specimens in the as-coated condition. I.v.L.

N64-14013 Rock Island Arsenal Lab., Ill.
MULTIMETAL COATING PROCESS FOR COMPOSITE STEEL, MAGNESIUM AND ALUMINUM STRUCTURES Interim Report
Jodie Doss 24 Oct. 1963 13 p refs
(RIA-63-3471; AD-427131)

Corrosion-resistant coatings were tested for use in recoating structurally united components containing dissimilar metals. Aluminum, steel, and magnesium metal assemblies were coated simultaneously. Composite specimens, trimetal assemblies containing various alloys of aluminum, and composite specimens containing a large aluminum panel and a small magnesium panel, or the reverse, were processed in stannous pyrophosphate solution. Solutions containing other tin compounds were investigated for use as coatings for trimetal assemblies. Author

N64-14017 Union Carbide Research Inst., Tarrytown, N.Y.
HIGH TEMPERATURE THERMAL EXPANSION OF CERTAIN GROUP IV AND V CARBIDES
C. R. Houska Dec. 1963 7 p refs
(Contract DA-30-069-ORD-2787)
(Tech. Rept. C-18; AD-426743)

The thermal expansions of HfC, NbC, and TaC have been measured to over 2000° C by an X-ray method. Mean coefficients of linear expansions are $6.38 \times 10^{-6} + 3.8 \times 10^{-10}$ (T-25) for HfC, $6.35 \times 10^{-6} + 5.2 \times 10^{-10}$ (T-25) for NbC, and $6.00 \times 10^{-6} + 5.6 \times 10^{-10}$ (T-25) for TaC. Author

N64-14034 International Resistance Co., Philadelphia, Pa.
PRECISION VOLUME RESISTOR Interim Development Report No. 2, 1 Sep.-30 Nov. 1963
M. Burk and Kenneth M. Merz 20 Dec. 1963 31 p refs
(Contract NObsr-89439)
(AD-426117)

Progress was reported in the following areas: (1) Alumina-glass bodies with different compositions were prepared and fired at different temperatures. The density, porosity, shrinkage, and mechanical strengths of the calcined specimens were determined. The alumina-chromia system was investigated from the point of view of the formation of solid solutions and obtaining a conductive matrix. (2) The oxidation of palladium and nickel plates was studied. (3) The preparation of resistors

with two conducting phases was initiated. The first set of resistors containing various ratios of carbon and palladium was prepared. Their most important properties were determined. (4) An investigation of methods of preparing colloidal-size nickel particles, particularly in the form of stable hydrosols, has been performed. Author

N64-14037 General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility
ENERGY STORAGE MECHANISMS IN LIQUID HYDROGEN
H. G. Carter 31 Oct. 1962 130 p refs
(Contract AF 33(657)-7201)
(NARF-62-15T; AD-293885)

Energy-storing molecular products of radiation in liquid hydrogen are examined from the point of view that the expulsion of potential energy in the form of such products may lead to lower design weights for nuclear rockets. It is found that a significant fraction of the energy deposited by radiation in liquid hydrogen is stored temporarily through the dissociation and excitation of H_2 molecules. Experimental and theoretical results are consistent with a rate of dissipation of such energy into thermal motion which is much slower than the rate at which the radiation products are expelled from the tank. It is shown that, if this is the case, relatively high levels of infrared radiation are to be expected, but that such energy will not rapidly be translated into thermal motion. Author

N64-14040 Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
CADMIUM SELENIDE Data Sheets
N. Neuberger Nov. 1963 60 p refs
(Contract AF 33(616)-8438)
(DS-134; AD-425216)

The Electronic Properties Information Center has been established to collect, index, and abstract the literature on the electrical and electronic properties of materials and to evaluate and compile the experimental data from that literature. A modified coordinate index to the literature is machine stored and printed for manual use. The center publishes data sheets, summary reports, thesauri, glossaries, and similar publications as sufficient information is evaluated and compiled. This report consists of the compiled data sheets on cadmium selenide. Author

N64-14094 Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
ZINC OXIDE Data Sheets
M. Neuberger Oct. 1963 50 p refs
(Contract AF 33(616)-8438)
(DS-133; AD-425212)

The Electronic Properties Information Center has been established to collect, index, and abstract the literature on electrical and electronic properties of materials and to evaluate and compile the experimental data from that literature. This report consists of the compiled data sheets on zinc oxide. Author

N64-14101 Union Carbide Research Inst., Tarrytown, N.Y.
RESEARCH ON PHYSICAL AND CHEMICAL PRINCIPLES AFFECTING HIGH TEMPERATURE MATERIALS FOR ROCKET NOZZLES Quarterly Progress Report [1 Oct.-31 Dec. 1963]
Robert Lowrie 31 Dec. 1963 68 p refs
(Contract DA-30-069-ORD-2787; ARPA Order 34-63)
(AD-426741)

Gas-solid reaction studies, physical and mechanical properties, and specimen preparation and characterization are the areas investigated in this study. This program is concerned with the principles of high temperature chemical and physical behavior, especially in respect to the successful performance of materials used as rocket components under high temperature operation. The major group of materials being studied consists of the refractory carbides and borides of the transition metals. Considerable effort is being devoted to the preparation of powders of these compounds with good purity and to their fabrication into test specimens without contamination. C.L.W.

N64-14167 Rochester U., N.Y. Inst. of Optics
INTRINSIC PHOTOCONDUCTIVITY IN THE ALKALI HALIDES
G. R. Huggett (Ph.D. Thesis) and K. Teegarden Jul. 1963 118 p refs
(Contract DA-ARO(D)-31-124-679)
(AROD-204-8; AD-428111) OTS: $9.60

Photoconductivity in thin films of RbI, KBr, KCl, and RbCl has been measured at temperatures of 10° K and 80° K. The schubweg [thrust path] of the electrons and the absolute value of the quantum efficiency times one minus the reflectivity [$Na(1-R)$]were determined. In RbI the value of $Na(1-R)$ at the photon energy corresponding to the peak at $n = 2$ was down from its maximum value by over an order of magnitude at 80° K and by about two orders of magnitude at 10° K. Its value in the peak corresponding to $n = 3$ was down only by about a factor of three at 80° K and by over an order of magnitude at 10° K. The band gaps at 80° K for the materials estimated from these curves are: RbI, 6.36 ev; KBr, 8.0 ev; KCl, 8.9 ev; and RbCl, 8.5 ev. Author

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see:* 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-13422 Centro Brasileiro De Pesquisas Físicas, Rio de Janeiro
ON THE ABUNDANCE OF EXTREME POINTS OF A FINITE AND CLOSED CONVEX SET [SUR L'ABONDANCE DES POINTS EXTREMAUX D'UN ENSEMBLE CONVEXE BORNE ET FERME]
Leopoldo Nachbin 1963 8 p refs In FRENCH Submitted for Publication
(*Its* Notas de Física, v. 10, no. 13)

Given a collection of sets, α, it is established that α has the property of binary intersection if there exists no nonvacant subcollection, β of α, such that the intersection of β is empty and the intersection of two arbitrary elements of β is not empty. A typical example is that of the collection of closed, not empty intervals $[a,b] = \{x; a \leq x \leq b\}$ of a completely connected set; that is, of a prescribed set where all major parts are not empty. With respect to minor parts, an upper and lower boundary is admitted. Some results following from the following theorem are demonstrated: ξ is a real topological vector space locally distinctly convex if A is a bounded and closed part of ξ, such that the collection of $\lambda A + x$ for real $\lambda > 0$ and $x \in \xi$ has the property of binary intersection, in which case A is the closed convex envelope of the set of its extreme points. M.P.G.

N64-13424 Centro Brasileiro de Presquisas Fisicas, Rio de Janeiro
RECENT RESULTS AND PROBLEMS OF AN ALGEBRAIC NATURE IN APPROXIMATION THEORY [RESULTATS RECENTS ET PROBLEMES DE NATURE ALGEBRIQUE EN THEORIE DE L'APPROXIMATION]
Leopoldo Nachbin 1963 13 p refs in FRENCH Submitted for Publication
(*Its* Notas de Fisica, v. 10, no. 14)

This report discusses known results and some open problems of the theory of approximation for continuous or differentiable real functions, in the case of algebras and modules of such functions. The study is made from the point of view of the theory of Weierstrass, which deals with compact uniform convergence, and leads to the more general theory of Bernstein, that is, for uniform convergence considered over elements not necessarily compact. Trans. by E.W.

N64-13494 United Nuclear Corp., White Plains, N.Y. Development Div.
AN IBM-7090 MONTE CARLO PROGRAM TO CALCULATE NEUTRON TRANSPORT IN CYLINDRICALLY SYMMETRIC SHIELDS WITH PARTICULAR EMPHASIS ON NEUTRON HEATING IN LIQUID HYDROGEN
G. Rabinowitz, F. Malmborg, and M. Shapiro 1 Nov. 1962 64 p refs
(NASA Contract NAS5-633; Contract SNPC-5; UNC Proj. 2188)
(NASA CR-55244; UNC-5043) OTS: $6.60 ph, $2.12 mf

A homogenized reactor provides the radiation source, and a shield exists between the fuel tank and the reactor. The assemblage is assumed to be in a vacuum. Special edits have been prepared to evaluate the following from the results of the main program: (1) fast neutron dose for near axis points, (2) the spatial distribution of neutron captures in hydrogen, and (3) the angle-energy distribution of particles passing through specified planes of the configuration. Author

N64-13571 Joint Publications Research Service, Washington, D.C.
APPROXIMATE DETERMINATION OF NUMBER OF SECTIONS IN PIECEWISE-LINEAR APPROXIMATION
L. P. Afinogenov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 52-61 refs (See N64-13565 05-01) OTS: $3.00

Equations are derived for approximate determination of the number of broken lines in a piecewise-linear approximation. From these equations, the border points of the approximating sections (provided there are no points where the curve is bent) can also be found. R.T.K.

N64-13594 Stanford Research Inst., Menlo Park, Calif.
AN OUTLINE AND DISCUSSION OF THREE PROPOSED METHODS FOR THE DATA ANALYSIS OF RADAR RETURN PULSES
G. W. Evans II, R. C. McCarty, and G. L. Sutherland Aug. 1963 40 p refs
(Contract SD-103; ARPA Order 281-62)
(Rept. SRI-MR-5; AD-343823)

This report suggests extensions for the application of the covariance and power spectral-density functions and for the finite Fourier transform and conjugate transform. These extensions are proposed for the analysis of radar return pulses when more than one data sample may be extracted from each return pulse. Author

N64-13609 Montana State Coll., Bozeman Electronics Research Lab.
TOPICS IN THE THEORY OF ONE-DIMENSIONAL ITERATIVE NETWORKS Scientific Report No. 5
William L. Kilmer Oct. 1963 34 p refs
(Contract AF 19(604)-6619)
(AFCRL-63-328; AD-425943)

It is proved that many one-dimensional iterative logic systems have cell types that cannot be equivalently decomposed into partially separate left-to-right and right-to-left subcells, almost regardless of the slightness of subcell separation and/or the weakness of system equivalence required. The paper also summarizes several new results on the dynamic behavior of iterative networks of Hennie's decomposable type. Author

N64-13622 Parke Mathematical Labs., Carlisle, Mass.
SELECTED ANNOTATED BIBLIOGRAPHY ON SYSTEMS OF THEORETICAL DEVICES Scientific Report No. 4
C. Robert Montgomery Sep. 1963 51 p refs
(Contract AF 19(628)-2417)
(AFCRL-63-515; AD-425691)

Abstracted papers are grouped in chronological order under four general categories: (1) automata and self-duplicating machines; (2) logic, including computing and abstraction; (3) neurophysiological systems, including bionics and simulation; and (4) switching, including electrical systems. The scope of the material included under each of these headings is limited to theoretical devices as opposed to hardware and practical technology. An author index is included. M.P.G.

N64-13655 Aerospace Research Labs., Wright-Patterson AFB, Ohio
PERCENTAGE POINTS OF THE RATIO OF RANGES OF SAMPLES FROM A RECTANGULAR DISTRIBUTION
Paul R. Rider Nov. 1963 17 p refs
(ARL 63-194; AD-426107)

Tables are given of the upper percentage points of the distribution of the ratio of the ranges of samples from a rectangular population. The ranges are from samples of sizes 2 to 15 inclusive, and the percentage points given are those corresponding to upper tail probabilities of 0.10, 0.05, 0.025, 0.01, and 0.005. Values are given to five decimal places. Comparison is made with the corresponding percentage points of the distribution of the ratio in samples from a normal population. Author

N64-13685 Joint Publications Research Service, Washington, D.C.
SYSTEM OF PROGRAMMED CONTROL OF A TELESCOPE INTENDED FOR OBSERVATIONS UNDER LIMITED PROGRAMS
Z. N. Kuteva and Yu. A. Sabinin *In its* New Methods in Astronomy 10 Jan. 1964 p 86-101 refs (See N64-13676 05-01) OTS: $3.00

A system of programed control of telescopes, based on rotating transformers and other continuous-action elements, is discussed. The system can be employed for the automatic finding of stars with an accuracy of one to two feet (without systems of correction). P.V.E.

N64-13754 Wisconsin U., Madison Mathematics Research Center
ON A CLASS OF FUNCTIONS OF REGULAR ASYMPTOTIC BEHAVIOR

R. Bojanic and J. Karamata Oct. 1963 36 p refs
(Contract DA-11-022-ORD-2059)
(MRC-436; AD-426492)

Let f be defined for all $x \geq 0$ and integrable on every finite interval. Suppose also that there exists a slowly varying function L and a real number σ such that

$$\lim_{x \to \infty} \frac{f(\lambda x) - f(x)}{x^{\sigma} L(x)} = H(\lambda) \qquad (1)$$

exists and is finite for all $\lambda > 0$. If $\sigma \neq 0$ the asymptotic relation (1) implies already that $H(\lambda) = A(\lambda^{\sigma} - 1)$. It implies also that $f(x) = C + Ax^{\sigma} L(x) + o(x^{\sigma} L(x))$ $(x \to \infty)$ where C is a constant equal to 0 if $\sigma > 0$. If $\sigma = 0$ $H(\lambda) = A^* \lg \lambda$ is obtained, and the following asymptotic representation for f is

$$f(x) = \int_1^x \delta(t)\, L(t)/t\, dt + C + o(L(x)) \quad (x \to \infty)$$

where C is a constant equal to 0 if $L(x) \to \infty$ $(x \to \infty)$ and δ a function such that $\delta(x) \to A^*(x \to \infty)$. In another case, given a function g, a real number σ and a slowly varying function L, necessary and sufficient conditions are presented for the existence of a nondecreasing function g^* such that the function $f = g + g^*$ satisfies the asymptotic relation (1). If the function Ω is defined for every $\lambda > 1$ by

$$\Omega(\lambda) = \limsup_{x \to \infty} \sup_{x \leq t \leq \lambda x} \frac{g(t) - g(x)}{x^{\sigma} L(x)}$$

then the necessary and sufficient condition mentioned above can be stated simply as follows:

$$\liminf_{\lambda \to 1+0} \frac{\Omega(\lambda)}{\lambda - 1} < \infty$$

Author

N64-13757 Naval Research Lab., Washington, D.C.
A COLLECTION OF FORTRAN PROGRAMS FOR CRYSTAL STRUCTURE ANALYSIS
H. G. Norment 29 Apr. 1963 77 p refs
(NRL-5885; AD-404653) OTS: $2.00

Descriptions and operating instructions for a collection of general utility programs are presented. All coding is done in FORTRAN II language for 32K core IBM 704 and 7090 machines; the FORTRAN-language programs are completely listed in the appendix. The data input to many of the programs has been designed to be compatible with the output of the automatic data-reduction program XRDDR, given in a previously published report. In the form presented in this report, the programs are written for use with the IBM-7090 IB Monitor system. Author

N64-13816 Auerbach Corp., Philadelphia, Pa.
RELIABILITY PREDICTION FOR DEGRADABLE AND NON-DEGRADABLE SYSTEMS Final Report
Sheldon J. Einhorn and Morris Plotkin Bedford, Mass., AFSC, Directorate of Computers, Nov. 1963 44 p refs
(Contract AF 19(628)-2824)
(ESD-TDR-63-642; AD-426087)

A "nondegradable" system has two states of interest: UP and DOWN. For a "degradable" system, there is at least one intermediate state of interest. Systems which are repairable and which may include redundant subsystems are considered. Essentially no assumption is made about subsystem UP-time and DOWN-time distribution other than their mutual independence. Under these very general assumptions, formulas are developed for the system availability, mean UP-time and mean DOWN-time. A system "condition" is defined by identifying which subsystems are UP and which are DOWN. A formula for the mean duration of system conditions is developed. An analysis is presented of the sensitivity of the formulas to errors in the arguments of the functions. The major problem in considering degradation of degradable subsystems is shown to be the association of values with instantaneous system performance. This problem is essentially not subject to rigorous analysis, but a mathematical framework useful in considering it is discussed. Author

N64-13822 Wisconsin U., Madison
SINGULAR PERTURBATIONS AND SOME NON LINEAR BOUNDARY VALUE PROBLEMS
J. L. Lions Oct. 1963 38 p refs
(Contract DA-11-022-ORD-2059)
(MRC-421; AD-426497)

The solution of boundary value problems for parabolic equations (or systems), linear and nonlinear, in domains which are not necessarily cylindrical, are a limit (in suitable topologies) to solutions of boundary value problems for elliptic equations (or systems). This singular perturbation result is proven here for the Navier–Stokes system of equations. Author

N64-13823 Wisconsin U., Madison
ON SLOWLY VARYING FUNCTIONS AND ASYMPTOTIC RELATIONS
R. Bojanic (Ohio State U.) and J. Karamata Oct. 1963 59 p refs
(Contract DA-11-022-ORD-2059; NSF Grant 7612)
(MRC-432; AD-426495)

A survey is given of basic properties of slowly varying functions. The notion of quasi-monotone functions is introduced and it is shown that a quasi-monotone slowly varying function can be represented as a quotient of two nondecreasing functions. The same problem of representation is also considered for some subclasses of quasi-monotone slowly varying functions. As an application of the results obtained, the following were studied: (1) asymptotic behavior of the linear transformation $\int_0^{\infty} f(t)L(xt)dt$ $(x \to \infty)$ of a slowly varying function L(x); (2) asymptotic behavior of trigonometrical series of the form $\sum_{n=1}^{\infty} a_n \sin nx$ $(x \to +0)$ where $a_n = n^{-\alpha} L(n)$. Author

N64-13824 Wisconsin U., Madison
ON ASYMPTOTIC BEHAVIOUR OF LINEAR TRANSFORMATIONS OF SLOWLY VARYING SEQUENCES AND OF SEQUENCES OF REGULAR ASYMPTOTIC BEHAVIOUR
M. Vuilleumier Oct. 1963 49 p refs
(DA-11-022-ORD-2059)
(MRC-435; AD-426491)

The linear transformations of sequences of real numbers which preserve the asymptotic properties of these sequences have been studied. Considered in particular, were linear transformations of slowly varying sequences and of sequences of regular asymptotic behavior. As is well known, a sequence $\{L_n\}$ is slowly varying if $L_n > 0$, $n = 1, 2, \ldots$, and

$$L_{[\lambda n]}/L_n \to 1 \; (n \to \infty)$$

for every $\lambda > 0$. On the other hand, a sequence $\{r_n\}$ is of regular asymptotic behavior if $r_n = n^{\sigma} L_n$, $n = 1, 2, \ldots$, where $\{L_n\}$ is a slowly varying sequence and σ any real number. Necessary and

sufficient conditions are given for a matrix $(a_{n,k})$ in order that it transform every slowly varying sequence into an asymptotically equivalent one. The same problem is considered for sequences of regular asymptotic behavior and also for slowly varying sequences which are asymptotically equal to a monotone sequence. Author

N64-13825 Wisconsin U., Madison
CERTAIN INDUCED MEASURES AND THE FRACTIONAL DIMENSIONS OF THEIR "SUPPORTS"
S. D. Chatterji Nov. 1963 19 p refs
(Contract DA-11-022-ORD-2059)
(MRC-438; AD-426493)

A direct proof for a slightly generalized version of a theorem of Kakutani concerning product measures is presented. A class of measures on the unit interval is considered as a special case, and the fractional (Hausdorff) dimensions of the "supports" of these measures are calculated. Finally, it is shown how a certain class of absolutely continuous measures can be represented as convolutions of singular measures based on small sets (in the sense of the Hausdorff dimension). In particular, the Lebesgue measure on the unit interval is demonstrated as a convolution of two singular measures each based on a set having fractional dimension zero. Author

N64-13848 Radio Corp. of America, Burlington, Mass.
INVESTIGATION OF THE APPLICATION OF STOCHASTIC SWITCHING TECHNIQUES TO THE ECCM PROBLEM
Howard E. Etter and Fred J. Morin Bedford, Mass., Electronic Systems Div., Oct. 1963 21 p refs
(Contract AF 19(604)-8859)
(ESD-TDR-63-186; AD-427111)

Three stochastic devices previously developed by the Control Sciences Laboratory were investigated to determine their applicability to the ECCM problem. Lacking a clear cut application some consideration was given to other possible uses. Additional information was gathered from the literature relative to the general field of stochastic and adaptive devices. Author

N64-13855 RAND Corp., Santa Monica, Calif.
CLOSURE TECHNIQUES FOR INFINITE SYSTEMS OF DIFFERENTIAL EQUATIONS
Richard Bellman and John M. Richardson Nov. 1963 11 p refs
(Contract ARPA-SD-79; ARPA Order 189-61)
(RM-3821-ARPA; AD-426174)

Previously, various closure techniques were applied to the problem of obtaining approximate solutions of nonlinear differential equations. These questions fall within the area of differential approximation. Starting with a vector system $dx/dt = g(x)$, it is replaced by another system $dv/dt = h(y)$, with simpler analytic and computation properties in such a way that $||x - y||$ is small. In some cases it is sufficient to have $h(y)$ linear, i.e., of the form $Ay + b$; in other cases it is sufficient that the dimension of y be considerably less than that of x. In this paper, the case is considered in which the original system is of infinite dimension and the approximating system is of finite dimension. Infinite dimensional systems arise in a natural fashion from the consideration of partial differential equations. Author

N64-13857 Northwestern U., Evanston, Ill. Technological Inst.
AN OPPOSITE SIGN ALGORITHM FOR "PURIFICATION" TO AN EXTREME POINT SOLUTION
A. Charnes and K. Kortanek Jun. 1963 8 p refs
(Contract Nonr-1228(10))
(ONR Memo-84)

Several important and efficient methods of solution of specific types of linear programing problems have the troublesome feature for managerial applications of sometimes providing optimal solutions which, are not basic solutions. It is desirable to start from a feasible solution, not necessarily optimal, which is either suggested by company personnel or by various pertinent qualitative considerations, and to proceed automatically to a basic solution at least as good as the suggested one. The purpose of this paper is to show how part of the proof technique of the opposite sign theorem can be employed in a simple algorithmic method to achieve this end. An IBM-709 code for executing this algorithm is being written and tested. E.W.

N64-13859 Northwestern U., Evanston, Ill. Technological Inst.
ON A MIXED-SEQUENTIAL ESTIMATING PROCEDURE WITH APPLICATION TO AUDIT TESTS IN ACCOUNTING
A. Charnes, H. Justin Davidson (Jouche, Ross, Bailey, and Smart) and K. Kortanek Aug. 1963 25 p refs
(Contract Nonr-1228(10))
(ONR-RM-81; AD-422786)

This new statistical model, or estimating procedure, involves the combination of sequential and fixed-size procedures. The resulting mixed procedure begins with the sequential part and continues to an *a priori* fixed total in the event of nonacceptance. Hence the procedure yields one of two final conclusions—either to accept the prescribed hypothesis with a specified risk or error, or a confidence interval estimate of the unknown error rate. The auditor using this procedure can sample, sequentially, one item at a time and at each item he can compare the observed number of errors with the tabulated acceptance and rejection numbers. Three cases occur: (1) If the observed errors are less than the acceptance number, sampling is terminated. (2) If the observed errors are greater than the acceptance number, and less than the rejection number, sampling is continued. (3) If the observed errors are greater than the rejection number, additional items to meet a total fixed sample size are drawn. I.v.L.

N64-13866 Michigan U., Ann Arbor Inst. of Science and Tech.
A STUDY OF BURGERS' MODEL EQUATION WITH APPLICATION TO THE STATISTICAL THEORY OF TURBULENCE
David W. Moomaw Dec. 1963 118 p refs
(Contract DA-36-039-SC-78801; Proj. Michigan)
(Rept. 2900-373-T; AD-426321)

This study investigates the statistical properties of some approximate solutions to the following equation and compares them with the statistical properties of real turbulence:

$$\frac{\partial u}{\partial t} = u\frac{\partial u}{\partial x} = \nu\frac{\partial^2 u}{\partial x^2} \quad [u(x, 0) \text{ specified}].$$

In one case, $u(x, 0)$ is assumed to be a Gaussian random function, and the statistical behavior of $u(x, t)$ is calculated to several orders in time. It is found that $u(x, t)$ remains normally distributed to the order of the terms calculated, although the joint distributions immediately deviate from joint normality. The

skewness and flatness factors of derivatives of u(x, t) are in qualitative agreement with experimental results of real turbulence. Another case uses a closed form solution for u(x, t) found by J. D. Cole. A steepest-descents type of approximation leads to a simple expression for u(x, t). Certain restrictions are imposed on u(x, 0) to facilitate calculations. It is found that the probability distributions of u(x, t) become normal after long times. Author

N64-13891 Columbia U., New York, N.Y.
SOME OPTIMUM CONFIDENCE BOUNDS FOR ROOTS OF DETERMINANTAL EQUATIONS
T. W. Anderson 8 Nov. 1963 44 p refs
(Contract Nonr-266(33); Nonr-4195(00))
(CU-70-63)

The problem considered in this paper is to obtain confidence intervals for all characteristic roots of a population covariance matrix. Author

N64-13895 General Electric Co., Cincinnati, Ohio
PART II, INCONEL X Seventh Quarterly Report
R. J. Favor and H. G. Popp 1 Nov. 1963 122 p refs
(Contract AF 33(657)-8017)
(AD-422433)

Test data and summaries of test results are presented for tests carried out on Inconel X. The purpose of the tests was to determine the following: (1) room-temperature tensile properties of thin-gage Inconel X sheet; (2) tensile and rupture properties; (3) low-temperature tensile, impact, and thermal shock properties; (4) tensile properties of Inconel X with heat treating; (5) the effect of three braze cycles on the mechanical properties of Inconel X bar; (6) the effect of aging temperature on the tensile properties of Inconel X sheet; (7) the tensile properties of Inconel X exposed to brazing and aging cycles; (8) parent material vs welded tensile and rupture data on Inconel X plate; (9) tensile properties of parent and welded plate; and (10) stress-range design curves for Inconel X. P.V.E.

N64-13916* Westinghouse Electric Corp., Baltimore, Md. Electronics Div.
SELF-REPAIR TECHNIQUES FOR FAILURE-FREE SYSTEMS Special Technical Report No. 2
M. R. Cosgrove and C. G. Masters Sep. 1963 40 p refs
(NASA Contract NASw-572)
(NASA CR-55267) OTS: $3.60 ph, $1.40 mf

Several classes of "repair" strategies under consideration and the computer simulation program which is used to determine the performance of the systems for each strategy are described. The computer simulation program determines the performance of a particular strategy by injecting random failures throughout the system and simulating system reaction according to the "repair" pattern of the strategy in question. The program prints out system performance in terms of: (1) total time to failure; (2) average time to failure; (3) number of failures to system failure; and (4) number of switches affected. The results for the two classes of strategies for which curves were drawn show that with the addition of a minimal amount of self-repair capability, the reliability of the system can be substantially increased over that of a comparable system using fixed redundancy alone for failure protection. Author

N64-13924 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany)
AN ANALOG-DIGITAL DATA RECORDING EQUIPMENT FOR TEST OF JET ENGINES [EINE ANALOG-DIGITALE MEβWERTERFASSUNGSANLAGE FUR VERSUCHE AN STROMUNGSMASCHINEN]
B. Dittie Sep. 1963 31 p refs In GERMAN

Analog–digital test recording equipment for investigating jet engines is discussed. All "computing points" should be interrogated, cyclic and in succession, and the test data should be registered in the form of a printed table and a punched tape (or magnetic tape) that can be evaluated on a program-routed electronic digital computer. The speed of interrogation must be sufficiently high so that no nominal change in the test data can take place during one cycle. In addition, the recurring test magnitudes must be ascertained, registered, and recorded immediately during the test; this can be accomplished by an electronic analog computer. This computer permits the adjustment of the equipment to the parameters desired. Combining analog and digital computers into test-data recording equipment shortens the search time, permits control and routing of the test runoff, furnishes results which can be immediately appraised, stores the test data, and enables an exactly calculated evaluation on a program-routed digital computer. Such equipment is in use at the compressor test stand of the DVL institute for jet propulsion. Trans. by I.v.L.

N64-13939 National Bureau of Standards, Boulder, Colo.
BOUMAC, A MACRO-PROGRAMMING SYSTEM FOR SCIENTIFIC COMPUTATION
John H. Devenney and John J. Sopka 18 Dec. 1963 42 p refs
(NBS-TN-203) GPO: $0.30

The BOUMAC computing system will allow a scientist having no programing knowledge to perform the more commonly used macrocomputations, such as matrix operations, solution of linear equations, numerical integrations, curve fitting, statistical analyses, etc., with a high-speed electronic computer. The scientist needs only to know the various mathematical operations which are required to obtain the information he wants from the data and to learn to use a simple code with which to specify these mathematical operations. Author

N64-13966 Illinois U., Urbana Antenna Lab.
A NEW TECHNIQUE FOR SOLVING A CLASS OF BOUNDARY VALUE PROBLEMS
R. Mittra and J. R. Pace Sep. 1963 58 p refs
(Contract AF 33(657)-10474)
(Tech. Rept. 72; AD-426795)

An outline is presented of a scattering matrix technique that provides a formally exact solution, in a series form, for a wide class of electromagnetic and acoustic wave-propagation theory boundary-value problems, for which no such solutions at the present time exist. The class of problems to which the present technique is applicable is characterized by the fact that they are related to an auxiliary problem for which an exact solution in terms of Wiener–Hopf, function theoretic, or other methods, is available. It is shown that if the actual problem is a suitable modification of the auxiliary problem, then the solution of the given problem may be developed in a series form, the coefficients involved being expressible in terms of the known scattering coefficients of the auxiliary problem. P.V.E.

N64-13976 Stanford U., Calif.
ANALOG DIFFERENTIATION FOR CONTROL SYSTEMS
W. H. Horton and C. E. Steel Aug. 1963 46 p refs
(Contract Nonr-225(30))
(SUDAER-166; AD-426237)

This paper examines the standard methods for analog differentiation. It concludes that the compromised derivative circuit with paralleled capacitance and resistance in the feedback loop and added resistance in the input leg is the most satisfactory normal circuit, provided that the poles generated by the

components are suitably located. It shows furthermore that multipole derivative circuits can be devised from mathematical approximations of the type

$$\frac{A^m y^{(m)}}{m!} = \frac{1}{p!}(A_0 y_0 + A_1 y_1 + \ldots A_p y_p) + E.$$

Such circuits have greater discrimination against frequencies above a specific level and give a more accurate derivative for frequencies which are low relative to this cutoff point Author

N64-13983 Stanford U., Calif.
BIASED SAMPLING; THE NONCENTRAL HYPERGEOMETRIC PROBABILITY DISTRIBUTION Technical Report No. 70
Kenneth Ted Wallenius 29 Nov. 1963 56 p refs
(Contract Nonr-225(53))
(AD-426243)

Given is a transistor lot which is to be divided among two purchasers. The lot is dichotomized by some quality criterion, and it is assumed there are m high-quality items and n other items of tolerable quality. Purchaser G, who has contracted for r items, suspects the supplier of favoring purchaser H with respect to the m high-quality items. He therefore decides to test the hypothesis that the lot has been divided in a random manner against the alternative that the supplier is biased in favor of purchaser H. Fisher's exact test is appropriate to test the null hypothesis, but in order to examine the sensitivity of the test, the "degree of bias" must be defined, and the non-null distribution must be obtained. This report gives meaning to "degree of bias" when sampling from a finite population and obtains a distribution called the noncentral, hypergeometric probability distribution. Various properties of the distribution are studied, and asymptotic results are given. Author

N64-13995 Air Force Systems Command, Wright-Patterson AFB, Ohio
ACCURACY OF AN AUTOMATIC SECOND DERIVATIVE PLOTTER [Final Report]
G. K. Medicus Jul. 1963 17 p refs
(ASD-TDR-63-471; AD-415289)

The influences of the finite signal amplitude ΔV, the finite current sensing resistor R_J, the signal-producing resistor R_S, the noise, and the system hysteresis on the second harmonic curves of an automatic second-derivative plotter are determined experimentally for a simulated probe (Si-diode) and for a real Langmuir probe. It is found that, in general, undistorted second-derivative curves are obtainable without any of the three quantities having to be excessively low. Author

N64-14005 RAND Corp., Santa Monica, Calif.
A NUMERICAL TECHNIQUE FOR SOLUTION OF MULTI-DIMENSION HYDRODYNAMIC PROBLEMS
R. Bjork, N. Brooks, and R. Papetti Dec. 1963 66 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-2628-PR; AD-425951)

This memorandum discusses in detail a numerical method for solving the compressible, hydrodynamic equations under the limitations of (1) two space dimensions, (2) the inviscid approximation, and (3) the adiabatic approximation. The method allows for the occurrence of shocks, contact discontinuities, and interfaces. Under a proper prescription of initial and boundary conditions, the method generates solutions including the above physical phenomena. The basis of the method is the extension to two space dimensions of the particle-in-cell (PIC) concept first proposed by Harlow for a one-dimensional computational scheme. The PIC concept involves mass points moving in a Lagrangian sense through an Eulerian space grid. Besides mass, the points carry with them the proper amount of momentum, kinetic energy, and internal energy. The computational method approximates a set of partial differential equations containing terms in addition to those of the compressible, hydrodynamic equations under the approximations cited. Author

N64-14014 Massachusetts Inst. of Tech., Cambridge Civil Engineering Systems Lab.
ANALYTICAL AERIAL TRIANGULATION ERROR ANALYSIS AND APPLICATION OF COMPENSATING EQUATIONS TO THE GENERAL BLOCK TRIANGULATION AND ADJUSTMENT PROGRAM Final Technical Report, Mar. 1960-Feb. 1962
Ziad M. Elias, Frank S. Greatorex et al [1962] 153 p
(Contract DA-44-009-ENG-4420)
(R62-4; *Its* Publ. 153; AD-401689)

This report presents: (1) the nature of random and systematic errors and the basic techniques for treating their effects as applicable to the analytical photogrammetric problem; (2) the basic least-squares method and its incorporation in the computer program; (3) complete mathematical description of the program; (4) studies of the nature and effects of the important error sources—lens and camera errors, atmospheric refraction, film distortion; (5) the study of various techniques for the solution of simultaneous equations; (6) operating instructions; (7) the results, conclusions, and resulting recommendations of test runs of the final computer program. Author

N64-14035 Stanford U., Calif.
LIFTING-LINE THEORY AS A SINGULAR-PERTURBATION PROBLEM
Milton Van Dyke Aug. 1963 24 p refs
(Grant AF AFOSR-96-63)
(SUDAER-165; AD-426471)

The method of matched asymptotic expansions, recently developed for treating singular-perturbation problems, is applied to the flat unswept lifting wing of high aspect ratio. This yields a simplified equivalent of Prandtl's lifting-line theory, with the solution of an integral equation replaced by quadratures. The next approximation is calculated in general terms. Specific application is made to cusped, lenticular, elliptic, and rectangular planforms, and a comparison is drawn, where possible, with previous work. Additional nonuniformities at tips and other discontinuities are described, and procedures are outlined for their correction. Author

N64-14111 Massachusetts Inst. of Tech., Cambridge Research Lab. of Electronics
THRESHOLD DECODING
James L. Massey (Ph.D. Thesis) 5 Apr. 1963 131 p refs
(Contract DA-36-039-sc-78108; Contract DA-SIG-36-039-61-G14)
(MIT-TR-410; AD-407946) OTS: $10.10

Two procedures for decoding linear systematic codes, majority decoding and a posteriori probability decoding, are formulated. The essential feature of both methods is a linear transformation of the parity-check equations of the code into "orthogonal parity checks." The decoding decisions are then made on the basis of the values assumed by these orthogonal parity checks. For binary codes, the principal component required in the circuitry for instrumenting these decoding rules is an ordinary threshold logical element. For this reason, these decoding rules are referred to as forms of "threshold decoding." It is shown that threshold decoding can be applied effectively to convolutional codes up to approximately 100 transmitted

bits in length over an interesting range of rates. However, it is also shown that the probability of error at the receiver cannot be made as small as desired by increasing the length of the code that is used with threshold decoding; rather this probability approaches a nonzero limit as the code length is increased indefinitely. Author

N64-14126 Stanford U., Calif. Applied Mathematics and Statistics Labs.
MINIMUM ELLIPSOIDS
Donald D. Fisher 27 Aug. 1963 10 p refs
(Contract Nonr-225(37))
(Tech. Rept. 31; AD-426124)

A method for determining ellipsoids satisfying a certain minimum property (volume containing all of the points of S) is described. I.v.L.

N64-14127 Stanford U., Calif.
PRIMAL PARTITION PROGRAMMING FOR BLOCK DIAGONAL MATRICES
J. B. Rosen 8 Nov. 1963 25 p refs
(Contract Nonr-225(37))
(Tech. Rept. 32; AD-426108)

An efficient method is described for programing completely linear problems. The method applies the partition programing algorithm in the primal form, and this permits the solution of a very large linear problem by solving a sequence of smaller linear programing problems. J.R.C.

N64-14153* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. SECTION 4: A SUFFICIENT CONDITION IN OPTIMAL CONTROL
E. B. Lee 10 Dec. 1963 13 p refs
(NASA Contract NASw-563)
(NASA CR-55352; MH-MPG-1541-TR-4) OTS: $1.60 ph, $0.80 mf

A theorem is proven which covers most of the known cases where Pontriagin's maximum principle is a sufficient, as well as a necessary, condition for optimal control. Author

N64-14154* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. TIME OPTIMAL CONTROL OF LINEAR RECURRENCE SYSTEMS
E. B. Lee 18 Dec. 1963 11 p refs
(NASA Contract NASw-563)
(NASA CR-55350; MH-MPG-1541-TR-5) OTS: $1.60 ph, $0.80 mf

An algorithm is developed to compute the time-optimal control functions for plants represented by linear recurrence equations. Steering may be to convex sets defined by quadratic forms. Author

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-13467 Joint Publications Research Service, Washington, D.C.
RECENT DEVELOPMENTS IN HIGH-ALTITUDE WEATHER FORECASTING
M. A. Duytseva et al 15 Jan. 1964 32 p refs Transl. into ENGLISH of 3 articles from Tr. Tsentral. Inst. Prognozov (Moscow), Issue 120, 1963 p 34-57
(JPRS-22741; OTS-64-21296) OTS: $1.00

CONTENTS:

1. FLUCTUATIONS OF HIGH-ALTITUDE PLANETARY FRONTAL ZONES DURING NATURAL SYNOPTIC PERIODS M. A. Duytseva and D. A. Ped' p 1-12 refs (See N64-13468 05-21)

2. FORECASTING THE AT_{500} FOR THE NORTHERN HEMISPHERE FOR 3-5 DAYS N. I. Zverev p 13-18 refs (See N64-13469 05-21)

3. FORECASTING THE DEFORMATION OF A HIGH-ALTITUDE PLANETARY FRONTAL ZONE DURING NATURAL SYNOPTIC PERIODS D. A. Ped' p 19-29 refs (See N64-13470 05-21)

N64-13468 Joint Publications Research Service, Washington, D.C.
FLUCTUATIONS OF HIGH-ALTITUDE PLANETARY FRONTAL ZONES DURING NATURAL SYNOPTIC PERIODS
M. A. Duytseva and D. A. Ped' *In its* Recent Develop. in High-Altitude Weather Forecasting 15 Jan. 1964 p 1-12 refs (See N64-13467 05-21) OTS: $1.00

A study is made of the amplitudes of the deformation of high-altitude planetary frontal zones and the position of high-altitude troughs on AT_{500} maps during the natural synoptic periods. A classification of all processes as zonal and meridional, and western and eastern, is proposed. One of the possible explanations for the fluctuations of these zones as a result of change in solar activity is also given. Author

N64-13469 Joint Publications Research Service, Washington, D.C.
FORECASTING THE AT_{500} FOR THE NORTHERN HEMISPHERE FOR 3-5 DAYS
N. I. Zverev *In its* Recent Develop. in High-Altitude Weather Forecasting 15 Jan. 1964 p 13-18 refs (See N64-13467 05-21) OTS: $1.00

On the basis of the theory of random function, the plan for forecasting the AT_{500} (altitude of the 500-mb surface) for 3 to 5 days was formulated. An equation is given that describes the regularity of atmospheric circulation at the mean level of the troposphere of the Northern Hemisphere in the first approximation. From this equation, a method is obtained for computing the AT_{500} chart of the Northern Hemisphere. R.T.K.

N64-13470 Joint Publications Research Service, Washington, D.C.
FORECASTING THE DEFORMATION OF A HIGH-ALTITUDE PLANETARY FRONTAL ZONE DURING NATURAL SYNOPTIC PERIODS
D. A. Ped' *In its* Recent Develop. in High-Altitude Weather Forecasting 15 Jan. 1964 p 19-29 refs (See N64-13467 05-21) OTS: $1.00

Deformations of high-altitude planetary frontal zones in natural synoptic periods are analyzed. Classifications of processes into latitudinal and meridional, depending on the magnitude of deformation, are given. A method for forecasting the deformation for the following natural synoptic period is recommended. Author

N64-13472 France Direction De La Meteorologie Nationale, Paris
MEAN NUMBER OF DAYS WITH PRECIPITATION IN FRANCE I. PERIOD 1921-1950; II. PERIOD 1931-1960 [NOMBRE MOYEN DE JOURS DE PRECIPITATIONS EN FRANCE I. PERIODE 1921-1950; II. PERIODE 1931-1960]
Oct. 1963 45 p refs In FRENCH
(*Its* Monograph 29)

Reduced observational data on precipitation in France during the period from 1921 to 1950 were used to obtain values for neighboring weather stations. Isolines were charted which show the net rainfall differences in various parts of the country and permit the classification of Atlantic, Mediterranean, and continental regimes. Data from 1946 to 1960 were also charted, and the results are discussed with respect to total annual rainfall, regions of maximum annual rainfall, and monthly variations in the quantity and frequency of rain. M.P.G.

N64-13637 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
TURBULENCE CHARACTERISTICS OF THE FIRST 62 METERS OF THE ATMOSPHERE
Frank V. Hansen Dec. 1963 48 p refs
(ERDA-100; AD-426681)

Turbulent characteristics of the first 62 meters of the atmosphere are established for neutral conditions. The assumption was made that the roughness length is a constant, but dependent upon wind direction, fetch, and the height of the roughness elements. Data are presented for five recording periods during the late winter and early spring of 1958 and 1961. Computations of the basic wind profile and turbulence parameters are presented in tabular form. Author

N64-13770 McGill U., Montreal (Canada) Arctic Meteorology Res. Group
LONG WAVE RADIATION AND TOTAL RADIATION BALANCE AT THE SURFACE IN THE ARCTIC Scientific Report No. 8
E. Vowinckel and Svenn Orvig Oct. 1963 58 p refs
(Contract AF 19(604)-7415)
(AFCRL-63-909; AD-426319; *Its* Publ. in Meteorol. 62)

The long wave radiation emitted from the ground was calculated with the Boltzmann formula. The radiation received at the ground was determined from the temperature and humidity of the atmosphere, first for clear sky conditions (using the Elsasser radiation diagram), and then for 10/10 cloudiness with low, medium, and high clouds. These values were then corrected to actual cloud amounts and types. An analysis of the individual grid points shows that there are a few distinct types of radiation regimes: Norwegian Sea type, Continental type, Pack ice type. These are discussed, and the radiation balance for the Arctic is presented in sections along 65° N, 0° E and 120° E, as well as in twelve monthly maps. Estimates are obtained of the nonradiative transfer values (on a net monthly basis). Both the conduction below the surface and the turbulence above are much smaller than the radiation components. Author

N64-13802 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE FORECASTING OF CLEAR AIR TURBULENCE
Y. Sugimoto and K. Ono 20 Dec. 1963 25 p refs Transl. by JPRS into ENGLISH from Kirshocho Kevkyu Jiho (Tokyo) v. 14, 1962 p 80-93
(RSIC-115; AD-427037)

Examples of clear-air turbulence reported by crews of airlines in the Pacific during 1960 were analyzed. The following were investigated: (1) geographical distribution of clear-air turbulence; (2) altitude distribution of turbulences; (3) the relation between clear-air turbulence and distribution of pressure on the surface—the relation between vertical shear of a wind and clear-air turbulence, the relationship between the pressure trough and clear-air turbulence, and clear-air turbulence in a high-pressure region. Results of these investigations indicate that clear-air turbulence is likely to form in the following regions: (1) on the axis of a jet current, or in an area within 300 km from the axis to the north; (2) in the vicinity of a pressure trough, especially on the northern side of a trough where a jet current is well developed; (3) along a trough running from east to west in a subtropical high-pressure zone; and (4) in a region with a large curvature in a high-pressure zone. R.T.K.

N64-13814 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
AN EXAMPLE OF REMARKABLE VARIATIONS IN WEATHER TRENDS AND FORECASTING OF BEGINNING AND ENDING TIME BY SURFACE WEATHER CHART
J. Tahara 13 Dec. 1963 9 p Transl. by JPRS into ENGLISH from Kirshocko Kenkyu Jiho (Tokyo), v. 10, no. 4, 1958 p 358–360
(RSIC-109; AD-426804)

The daily weather conditions and daily precipitation in Tokyo for January through March 1954, and from July through September 1956 are given. R.T.K.

N64-14036 Minnesota U., Minneapolis School of Physics
THE FINE STRUCTURE OF THE ATMOSPHERIC FAIR WEATHER FIELD: AN INVESTIGATION OF SOME RELATED METEOROLOGICAL FACTORS
Homer T. Mantis Aug. 1963 14 p refs
(Contract Nonr-710(22))
(AP-23; AD-425947)

This report presents a possible explanation for short-period field oscillations of the fair weather field as observed by Steutzer in Minnesota in 1963. These oscillations of the fair weather field, with moderate to strong surface winds, had a higher frequency than other observed frequencies and occurred with less regularity. It is suggested that these oscillations are fluctuations of charge, separated in the condensation precipitation process. No support for the convection hypothesis, for explaining these oscillations, was obtained from wind analysis, and in fact other meteorological factors are more likely to be the cause of the electric field oscillation at convection frequencies. I.v.L.

N64-14137 Hawaii Inst. of Geophysics, Honolulu
TIROS OBSERVATIONS OF THE SUMMER CIRCULATION AND WEATHER PATTERNS OF THE EASTERN NORTH PACIFIC Scientific Report No. 5
James C. Sadler 19 Oct. 1963 52 p refs
(Contract AF 19(604)-6156)
(HIG-40; AFCRL-63-776; AD-426465)

The eastern North Pacific is dominated by a monsoonal circulation whose principal control is a low-level trough, or wind-shift zone, which has a mean position between 10° N and 15° N during August, September, and October. There is a reversal of wind flow across the zone, with westerly winds to the south and easterlies to the north. Vortices form along the shear zone and many intensify to tropical storms and hurricanes. A split or double convergence zone is associated with such a flow pattern, with the wind-shift line or monsoonal

trough being a region of minimum cloudiness. The principal convergence zone, as identified by the convective cloud system, is some 100 to 200 miles south of the trough line and lies within the west winds. A secondary convergence zone is within the easterlies to the north of the trough. Author

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-13574 Joint Publications Research Service, Washington, D.C.
CONCERNING THE CREATION OF A GYROSCOPIC LATITUDE COMPASS
M. M. Bogdanovich and P. A. Il'in *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 85–114 refs (See N64-13565 05-01) OTS: $3.00

High precision compact computers and small gyroscopic stabilizing platforms were incorporated into the design of a gyroscopic latitude compass. For the sensing element, a static three-stage gyroscope with a gimbal suspension, installed on a platform which is stabilized with respect to the horizon, was used. The signals received by the moment sensors are developed by computing devices. The conversion of the gyroscope into a gyro latitude compass was accomplished by applying the moment on the vertical axle of the suspension to the moment proportional to the angular velocity of the deflection of the main gyroscope axle from the line of the meridian. R.T.K.

N64-13674 Army Missile Command, Huntsville, Ala.
PRELIMINARY ANALYSIS AND EVALUATION OF ANALYTIC PLATFORM SYSTEMS—FY 63
Robert E. Alongi 21 Aug. 1963 94 p refs
(RG-TR-63-23; AD-426190)

Of the numerous instrument schemes devised for the analytic platform, five were selected for analysis. After preliminary analysis, it was determined that an analytic platform using state-of-the-art components was feasible for missiles having a range of 300 nmi or less. Equations are presented for the kinematics of rotating coordinate frames and several methods of coordinate transformations are demonstrated, including the use of Euler angles, the four-parameter representation of quaternion and Cayley–Klein parameters, and a vector representation of the missile's velocity vector. Tables showing error sources, trajectory parameters, and instrument orientation as determined during the analysis are also presented. Author

N64-13808 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
ANALYSIS AND DESIGN OF A SIMPLIFIED INERTIAL PLATFORM ALIGNMENT LOOP
Jerry L. Dooley and Herbert R. Mc Carley 19 Jul. 1963 47 p
(RG-TR-63-26; AD-426364)

In the present stabilized-platform alignment amplifier for the Pershing guidance and control system, the tachometer output signal is proportional to the pendulum output. Using the pendulum signals for a proportional signal in place of the tachometer reduces the null requirement of the alignment loop caused by the threshold of the motortachometer. A theoretical analysis of the present alignment loops and their effect on the platform servoloops is presented. A new and much simpler technique for mechanizing the aligment loops is proposed, and the feasibility of the technique is verified analytically. Author

N64-13809 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
DESIGN CONCEPT FOR THE ST-323 STABILIZED PLATFORM
Wilbur E. Grunwald 27 Nov. 1963 14 p refs
(RG-TR-63-29; AD-426352)

A study has been made to determine design characteristics required for advanced systems requiring inertial guidance. These requirements have been utilized with state-of-the-art instrument technology to produce the design concept for the ST-323 stabilized platform, whose design also includes Army test philosophy as well as performance requirements. Author

N64-14156* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. SECTION 3: MODES OF FINITE RESPONSE TIME CONTROL
C. A. Harvey 22 Nov. 1963 15 p refs
(NASA Contract NASw-563)
(NASA CR-55345; MH-MPG-1541-TR-3) OTS: $1.60 ph, $0.80 mf

A linear autonomous system with a single control variable is considered. There are, in general, several modes of finite-response time control for such a system. The concepts of single-component regulation and multiple-component regulation are defined. It is then shown that a multiple-component regulation problem can be transformed into a single-component regulation problem. Thus it is possible to express any of the modes of control considered as control of a single input, single output system. Author

23 PHYSICS, GENERAL

Includes acoustics; cyrogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-13423 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy) Laboratori Nazionali
A POSSIBLE METHOD FOR THE DISCRIMINATION OF SPURIOUS EVENTS IN THE SCINTILLATION CHAMBER—PRELIMINARY RESULTS [UN POSSIBLE METODO PER LA DISCRIMINAZIONE DI EVENTI SPURI IN CAMERA A SCINTILLE— RISULTATI PRELIMINARI]
R. Habel and T. Letardi 30 Oct. 1963 5 p refs in ITALIAN
(*Its* Nota Interna 215; LNF-63/65)

A promising method for discriminating between expected and spurious events in a scintillation counter is described. A pressurized spark-gap with a 3-nanosecond jitter and a scintillation counter consisting of aluminum plates of 0.5 mm thickness spaced 5.8 mm apart (for 10 gaps) were used. The interior of the counter was filled with argon at atmospheric pressure. Expected and spurious tracks were photographed and plotted for voltages of 8.0, 10.0, and 13.5 kv.
Trans. by P.F.E.

N64-13429 Technical Operations, Inc., Burlington, Mass.
QUANTUM-MECHANICAL CORRELATION THEORY OF ELECTROMAGNETIC FIELDS
J. Sarfatt *In its* Invest. of Coherent Optical Propagation Tech. Doc. Rept. Nov. 1963 11 p refs Repr. from Nuovo Cimento (Bologna), v. 27, no. 5, 1 Mar. 1963 ITALIAN Summary (See N64-13426 05-01)

A quantum-mechanical calculation of the space and time correlation functions of the electric field components in blackbody radiation is presented. The results obtained agree with Bourret who used a technique based on an analogy with the theory of isotropic turbulence of an incompressible fluid. The feasibility of actually measuring the correlation functions is discussed. Author

N64-13430 Technical Operations, Inc., Burlington, Mass.
ON THE MUTUAL COHERENCE FUNCTION IN AN INHOMOGENEOUS MEDIUM
George B. Parrent, Jr., Robert A. Shore (AF Cambridge Res. Labs.), and Thomas J. Skinner *In its* Invest. of Coherent Optical Propagation Tech. Doc. Rept. Nov. 1963 7 p refs Repr. from J. Math. Phys., v. 3, no. 4, Jul.–Aug. 1962 p 678–684 (See N64-13426 05-01)

The paper is concerned primarily with determining the mutual coherence function of the field produced by a plane quasi-monochromatic source in a region of variable refractive index. A scalar theory is used throughout. A brief review of the conceptual background of coherence theory is presented. An outline of the mathematical formalism of coherence theory is given, and it is shown that in a region of variable refractive index the mutual coherence function is propagated according to a pair of inhomogeneous scalar wave equations. The pair of wave equations are solved using appropriate Green's functions to derive an expression for the mutual coherence function of a field produced by a plane quasi-monochromatic source. The case of a statistically homogeneous medium is treated, and an expression for the ensemble average of the mutual coherence function is obtained in terms of integrals of the two-point correlation function characterizing the medium. Author

N64-13432 · RAND Corp., Santa Monica, Calif.
DYNAMIC PROPERTIES OF MATTER UNDER HIGH STRESS THERMODYNAMIC DESCRIPTIONS
Harold L. Brode and A. C. Smith *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 17–36 refs (See N64-13431 05-01)

Some empirical information is available in the regions of stress of a few kilobars to a few megabars from high-explosive shock experiments. Static compression data are useful guides at lower stresses, while at the highest levels it is found that the properties are reasonably well determined by atomic models such as a Fermi–Thomas–Dirac temperature-dependent model. Theoretical calculations, numerical in nature, have provided the thermodynamic properties of all atomic elements. The properties of chemical mixtures as occur in natural materials can be constructed from suitable combinations of these elementary results. Successful use has been made of such results for calculations of dynamic response under high-impulse loadings in a variety of aplications. One particular example (for basalt) is illustrated. Author

N64-13435 California Inst. of Tech., Pasadena Firestone Flight Sciences Lab.
DYNAMIC ANALYSIS IN VISCOELASTIC MEDIA
M. L. Williams and R. J. Arenz *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 79–116 refs (See N64-13431 05-01)

Distinguishing characteristics of viscoelastic media are reviewed with special reference to dynamic stress analysis. To circumvent the inherent computational difficulties in the usual transform type of solutions, an extension of the Schapery method is proposed for approximating the viscoelastic strain distribution due to wave effects. From an experimental standpoint, the use of photoelastic materials to model the responses due to dynamic loading is discussed. It is emphasized that quantitative analysis depends upon knowing the birefringence as a function of strain rate and temperature. The association of the stress and strain optic coefficients to mechanical properties is derived, and suggestions are made as to the determination of material characterization as a function of reduced strain rate. Author

N64-13436 California U., Berkeley
WAVE PROPAGATION PHENOMENA AND STRUCTURAL RESPONSE
Werner Goldsmith *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 117–121 (See N64-13431 05-01)

A discussion is presented of the general field of wave propagation as well as the mathematics, techniques, and phenomena associated with wave propagation. R.T.K.

N64-13440 Rensselaer Polytechnic Inst., Troy, N.Y.
SOME PROBLEMS IN DYNAMIC RESPONSE OF TWO-DIMENSIONAL STRUCTURES
W. H. Hoppmann II *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 207–223 refs (See N64-13431 05-01)

The paper presents a discussion of the problem of dynamical response of simple two-dimensional structures such as plates and shells to impulse loading. Consideration is given to the relationship between propagation of waves in the medium and the normal mode vibrations of the medium. Consideration is also given to the connection between the theory of dynamics of the three-dimensional continuum and that for the two-dimensional structures. The need for studies on one-dimensional bars is taken into account. The role of the constitutive equations and change of state of the material under load is briefly discussed. Author

N64-13441 Massachusetts Inst. of Tech., Cambridge
HYPERVELOCITY IMPACT STATUS OF EXPERIMENTS
Walter Herrmann and Arfon H. Jones *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 235–255 refs (See N64-13431 05-01)

A brief account of the development of hypervelocity impact experimentation is given, and the applicability of the presently available information to target design is discussed. Most of the available information refers to cratering in effectively semi-infinite targets, or penetration of a single thin target, at velocities below 10 km/sec. Author

N64-13442 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
PROJECTION TECHNIQUES
J. S. Curtis and J. W. Gehring *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 257–288 refs (See N64-13431 05-01)

This paper reviews the techniques used to accelerate projectiles to high velocity for impact and similar studies. Each type of projector is described briefly. Current performance capabilities are discussed, and it is found that light-gas guns are capable of launching projectiles of known and controllable

shape, mass, material, and orientation at velocities near 30,000 fps, that explosive techniques can accelerate certain projectiles of less well-defined shape and mass to a velocity of near 70,000 fps, but that electric guns have not yet launched sizable projectiles at even the relatively low velocity of 10,000 fps. It is concluded that light-gas guns and explosive devices are the most promising types for sizable projectiles, and the electrostatic accelerators and explosive devices are best for accelerating microparticles. Author

N64-13449 Turku U. (Finland) Astronomia-Optika Instit.
CONSTRUCTION AND DESIGN OF AN APLANATICALLY STABILIZED OBJECTIVE [FABRICATION ET ETUDE D'UN OBJECTIF STABILEMENT APLANETIQUE]
Liisi Oterma 1963 24 p refs In FRENCH
(*Its* Informo 26)

An aplanatically stabilized objective, with dimensions of 250/5157, was constructed, mounted on a tube, and studied by interferential methods of two slits and of two holes according to the method of M. Y. Väisälä. Calculations made concerning this objective indicated that improvement, per se, is unnecessary since the star images observed were entirely satisfactory. However, concerning irregularity defects, it should be determined whether these defects were due to surface flaws or irregularities of the refractive index of the lens glass. According to the glass manufacturers, Crown and Flint, the maximum possible irregularities in the refractive indices were a maximum of ± 0.000002 and ± 0.000003, respectively, for lenses with a thickness of approximately 20 mm. This indicates that the defects of the surfaces of the waves, proving the irregularity of the refractive indices, are of a maximum order of 40 nm and 60 nm, respectively. These were of the same order as the divergences of the surface of the waves of the constructed objective. It should be noted that the construction of an aplanatically stabilized objective merits being used at least for objectives with long focal lengths, where the spherical aberration of the surfaces is modest, since this type of objective with its strong positive curvature, must be more stable in respect to lens deflections than aplanatic objectives of ordinary construction. I.v.L.

N64-13496* Westinghouse Electric Corp., Baltimore, Md.
MIROS, OPTICAL SYSTEMS STUDY Monthly Progress Report No. 7, 20 Nov.-20 Dec. 1963
W. E. Ward 1963 6 p
(NASA Contract NASw-703)
(NASA CR-55250) OTS: $1.10 ph, $0.80 mf

The first modulation transfer scheme, the mercury cell, was successfully operated. An easily reproducible 50% absorption of the mercury 4047 A line was induced in the mercury absorption cell, upon its irradiation with 2537 A radiation, and a maximum absorption of 57% was obtained in one trial. Experiments were conducted to determine the dependence of the modulation transfer scheme on such parameters as gas pressures, intensity of the incident beams, modulation rates, sample purities, etc. The following results have been noted: (1) The 4047 A depends on the partial pressure of the added N_2. (2) The dependence of the modulation transfer scheme on two beam intensities was qualitatively noted. (3) The system is critically dependent on the purity of the nitrogen. R.T.K.

N64-13511 Firestone Tire and Rubber Co. Akron, Ohio
PROCEEDINGS OF THE SIXTH SYMPOSIUM ON HYPERVELOCITY IMPACT, CLEVELAND, OHIO, APRIL 30-MAY 2, 1963, VOLUME I
A. C. Charters et al Aug. 1963 402 p refs
(Contract DA-31-124-ARO(D)-16)
(AD-423798)

CONTENTS:

PROJECTION TECHNIQUES

1. A CRITIQUE OF ACCELERATOR TECHNIQUES FOR HYPERVELOCITY IMPACT A. C. Charters (Gen. Motors Corp.) p 1-40 refs (See N64-13512 05-23)

2. EXPERIMENTAL AND THEORETICAL STUDIES ON THE INTERIOR BALLISTICS OF LIGHT GAS GUNS P. G. Baer and H. C. Smith (Aberdeen Proving Ground) p 41-105 refs (See N64-13513 05-23)

3. AN INVESTIGATION OF THE PERFORMANCE OF A COMPRESSION HEATER FOR USE WITH GUN TUNNELS OR HYPERVELOCITY LAUNCHERS B. Lemcke (MIT) p 107-154 refs (See N64-13514 05-23)

4. COMPUTER ANALYSIS OF TWO-STAGE HYPERVELOCITY MODEL LAUNCHERS R. Piacesi, D. F. Gates, and A. E. Seigel (NOL) p 155-174 refs (See N63-18344 17-20)

5. NRL HYPERVELOCITY ACCELERATOR DEVELOPMENT H. F. Swift, C. D. Porter, J. J. Condon, and J. R. Baker (NRL) p 175-246 refs (See N64-13515 05-23)

6. PERFORMANCE OF A THREE STAGE ARC HEATED LIGHT GAS GUN J. Eckerman and W. L. Mc Kay (Avco Corp.,) p 247-303 refs (See N64-13516 05-23)

7. HYPERVELOCITY AUGMENTATION TECHNIQUES W. G. Howell, R. F. Recht, and T. W. Ipson (Denver Res. Inst.) p 305-316 refs (See N64-13517 05-23)

8. THE MAGNETOHYDRODYNAMIC HYPERVELOCITY GUN R. L. Chapman, D. E. Harms, and G. P. Sorenson (MB Assoc.) p 317-330 (See N64-13518 05-23)

9. INHIBITED JET CHARGE S. Kronman and A. Merendino (Aberdeen Proving Ground) p 331-348 refs (See N64-13519 05-23

10. SPECIAL EXPLOSIVE PROJECTORS: I. SHAPED CHARGE ACCELERATOR; II. TARGET PLATE ACCELERATOR K. N. Kreyenhagen, J. E. Ferguson, R. R. Randall, and J. P. Joyce (Aerojet-Gen. Corp.) p 349-373 refs (See N64-13520 05-23)

11. SUMMARY REMARKS H. F. Swift (NRL) p 375-377

N64-13512 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
A CRITIQUE OF ACCELERATOR TECHNIQUES FOR HYPERVELOCITY IMPACT
A. C. Charters *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30-May 2, 1963, Vol. 1 Aug. 1963 p 1-40 refs (See N64-13511 05-23)

The requirements for accelerator techniques are reviewed from the standpoint of their supporting role in the field of high-velocity impact. The areas of interest to high-velocity impact are noted, and their various demands on accelerators are discussed. The performance of the accelerators now in use are critically evaluated in terms of their ability to meet these demands. Author

N64-13513 Aberdeen Proving Ground, Md. Ballistic Research Labs.
EXPERIMENTAL AND THEORETICAL STUDIES ON THE INTERIOR BALLISTICS OF LIGHT GAS GUNS
Paul G. Baer and Horace C. Smith *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30-May 2, 1963, Vol. 1 Aug. 1963 p 41-105 refs (See N64-13511 05-23)

This paper reports the progress of a theoretical and experimental investigation designed to improve the performance of two-state light-gas guns used as hypervelocity launchers. Two

theories programed for the BRLESC digital computer are discussed. Predictions resulting from the application of the two theories are compared with experimental results obtained from a small, highly instrumented light-gas gun. The design of a longer high-performance light-gas gun capable of accelerating 1-g projectiles to velocities in excess of 20,000 fps is discussed. Author

N64-13514 Massachusetts Inst. of Tech., Cambridge.
AN INVESTIGATION OF THE PERFORMANCE OF A COMPRESSION HEATER FOR USE WITH GUN TUNNELS OR HYPERVELOCITY LAUNCHERS
Bo Lemcke Mar. 1963 *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 107–154 refs (See N64-13511 05-23)

Two main modifications of the free-piston compression heater have been considered for improving the performance of hypervelocity launchers and gun tunnels. To be able to predict the performance, analyses of the shock heating and the peak pressure generation including outflow of gas have been made. The conclusions from the analyses are that shock heating of hydrogen by means of a light piston at present seems very inefficient, that isentropic heating of the pump tube gas using a very high compression ratio would made it possible to launch very light projectiles at velocities of up to about 50,000 fps, and that for gun tunnels, stagnation temperatures of up to about 5500° K would be possible to obtain using hydrogen as driving gas. Author

N64-13515 Naval Research Lab., Washington, D.C.
NRL HYPERVELOCITY ACCELERATOR DEVELOPMENT
H. F. Swift, C. D. Porter, J. J. Condon, and J. R. Baker *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 175–246 refs (See N64-13511 05-23)
(ARPA Order 70; ARPA Order 149)

Present accelerators are light-gas guns of the semiexpendable-central-breech design which vary in size from 0.830 in., 0.30 in. units to an 8.2 in., 2.5 in. gun. The current launch capability of the facility ranges from 0.1 g at 9.35 km/sec to 250 g at 5.6 km/sec. The operation of gas guns is being studied theoretically with a computer program. An experimental study of various aspects of gun operation including projectile release, driver gas leakage, projectile-bore friction, and sabot breakup is also being conducted. The feasibility of electrically energizing hypervelocity accelerators has been experimentally and theoretically studied. The addition of electrical energy to the driver gas of a standard light-gas gun operating under reduced parameters has generated a 33% increase in gun performance. Electrical pulses have also been used to generate sheets of dense plasma that have accelerated thin plastic plates to velocities above 9 km/sec. Author

N64-13516 Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
PERFORMANCE OF A THREE STAGE ARC HEATED LIGHT GAS GUN
J. Eckerman and W. L. Mc Kay *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 247–303 refs (See N64-13511 05-23)
(Contract AF 04(694)-239)

The design, operation, performance, and internal ballistics are described for a caliber 0.600 light-gas gun with arc discharge heating of the driver gas. The complete development of the launcher is detailed. This includes the 300,000 joule capacitor bank construction, the effect of discharge time on performance, the effect of discharging at different times during the compression stroke, discharge chamber design, and switching technique. It is shown that improved launcher performance was obtained by arc discharge heating over the unheated configuration for the same mass projectile at the same maximum reservoir pressures. Author

N64-13517 Denver Research Inst., Colo.
HYPERVELOCITY AUGMENTATION TECHNIQUES
William G. Howell, Rodney F. Recht, and Thomas W. Ipson *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 305–316 refs (See N64-13511 05-23)

This paper presents analytical and experimental results from an initial investigation of a light-gas-gun projection system which shows promise of providing a breakthrough into the 35,000 to 50,000 fps velocity range. In this projection system, a third stage is added to the end of the launch tube of a conventional two-stage light-gas projector. This third stage is designed to make use of the kinetic energy which is available in the sabot at the time that a sabot–projectile combination is normally fired from the launch tube. It has a convergent section which acts as an acceleration chamber leading into a final launch tube having a smaller bore. The projectile is carried centrally on the face of the sabot and fits the bore of the final launch tube. Author

N64-13518 MB Associates, Walnut Creek, Calif.
THE MAGNETOHYDRODYNAMIC HYPERVELOCITY GUN
R. L. Chapman, D. E. Harms, and G. P. Sorenson *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963 Vol. 1 Aug. 1963 p 317–330 (See N64-13511 05-23)

A magnetohydrodynamic hypervelocity projector system is described which is potentially capable of accelerating a 0.1-gm mass to a velocity of 27 km/sec. The energy for compressing the accelerating magnetic field to megagauss values is derived from high explosives. A containment tank is included in the system so that the explosive can be detonated in a regular laboratory building. Theoretical and experimental work has been done, and 9.5 km/sec has been achieved to data. Author

N64-13519 Aberdeen Proving Ground, Md. Ballistic Research Labs.
INHIBITED JET CHARGE
S. Kronman and A. Merendino *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 331–348 refs (See N64-13511 05-23)

The inhibited jet charge is basically a shaped charge in which the conventional nonsteady state jet is inhibited so that only the leading particle is permitted to strike the target. By application of known principles of shaped-charge cone-angle geometry and of scaling laws, inhibited jet charges have been developed that project aluminum pellets of masses ranging from 0.5 to 30 g at velocities ranging from 7.6 km/sec to 11.7 km/sec. Pellet masses of several hundred grams are considered feasible with this device. Preliminary tests have indicated that copper and steel pellets can also be provided. Author

N64-13520 Aerojet-General Corp., Downey, Calif. Ordnance Div.
SPECIAL EXPLOSIVE PROJECTORS: 1. SHAPED CHARGE ACCELERATOR; 2. TARGET PLATE ACCELERATOR

K. N. Kreyenhagen, J. E. Ferguson, R. R. Randall, and J. P. Joyce *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 1 Aug. 1963 p 349-373 refs (See N64-13511 05-23)

The shaped-charge accelerator is currently being used to investigate impact phenomena for compact projectile shapes impacting individually at velocities in the range from 30,000 to 39,000 fps. Individual impacts are obtained by jet dispersion achieved through asymmetrical initiation. Individual projectile characteristics (velocity, shape, mass, orientation) are determined with multiple flash radiographs of the projectiles just prior to impact. It appears possible to launch shaped-charge accelerators with a large light-gas gun, such as the 8-in./2.5-in. Atkins gun at NRL, and thereby to achieve impact velocities in the 20-km/sec range. The target plate accelerator projects a flat plate which is allowed to impact a stationary "projectile" in its path. Damage to the plate is assessed by observing the plate in flight with flash radiographs subsequent to impact. This technique provides a unique means for studying impact effects of fragile or sensitive projectiles. Current accelerator designs provide impact velocities up to 3.5 km/sec. Author

N64-13521 Firestone Tire and Rubber Co., Akron, Ohio
PROCEEDINGS OF THE SIXTH SYMPOSIUM ON HYPERVELOCITY IMPACT, CLEVELAND, OHIO, APRIL 30-MAY 2, 1963, VOLUME 2, PART I
Robert L. Bjork et al Aug. 1963 348 p refs
(Contract DA-31-124-ARO(D)-16)
(AD-423063)

CONTENTS:

THICK TARGET CRATERING AND IONIZATION

1. REVIEW OF PHYSICAL PROCESSES IN HYPERVELOCITY IMPACT AND PENETRATION R. L. Bjork (RAND Corp.) p 1–58 refs (See N63-19789 19-33)

2. HYDRODYNAMICS OF HYPERVELOCITY IMPACT J. M. Walsh and J. H. Tillotson (Gen. Dyn. Corp.) p 59–104 refs (See N64-13522 05-23)

3. VISCO-PLASTIC SOLUTION OF HYPERVELOCITY IMPACT CRATERING PHENOMENON T. E. Riney (GE Co.) p 105–140 refs (See N64-13523 05-23)

4. THE CALCULATION OF STRESS WAVES IN SOLIDS M. L. Wilkins and R. Giroux (Calif. U.) p 141–155 refs (See N64-13524 05-23)

5. A HYPERVELOCITY IMPACT MODEL FOR COMPLELY DEFORMING PROJECTILES J. L. Luttrell (NOL) p 157–161 (See N64-13525 05-23)

6. SPHERICAL SHOCK WAVES AND CAVITY FORMATION IN METALS N. Davids, H. H. Calvit (Pa. State U.) and O. T. Johnson (Aberdeen Proving Ground) p 229–271 refs (See N64-13526 05-23)

7. PROPERTIES OF SPHERICAL SHOCK WAVES PRODUCED BY HYPERVELOCITY IMPACT R. Kinslow (Aro, Inc.) p 273–320 refs (See N64-13527 05-23)

8. SHOCK FRONT VARIATION IN TIME FOR HIGH SPEED IMPACT INTO WATER J. F. Heyda (GE Co.) p 321–336 refs (See N64-13528 05-03)

N64-13522 General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
HYDRODYNAMICS OF HYPERVELOCITY IMPACT
J. M. Walsh and J. H. Tillotson *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 59–104 refs (See N64-13521 05-23)
(Contract AF 29(601)-4759; ARPA Order 251-61; Proj. Defender)
(GA-3827)

Numerical techniques have been used to treat the hydrodynamic phase of axisymmetric hypervelocity impact. A series of iron-on-iron impact calculations are discussed in which the projectile velocity and target thickness are each varied over a wide range. An equation-of-state correlation and dimensional analysis then lead to a general description of like-metal impacts. Further, an observed late-time asymptotic solution within the stages of the interaction for which the hydrodynamic approximation is valid is used to predict the dependence of crater size upon impact velocity. For velocities between about $5(10)^5$ and $2.5(10)^7$ cm/sec, crater dimensions increase to the 0.62 power of impact velocity. Author

N64-13523 General Electric Co., King of Prussia, Pa. Space Sciences Lab.
VISCO-PLASTIC SOLUTION OF HYPERVELOCITY IMPACT CRATERING PHENOMENON
T. D. Riney *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 105–140 refs (See N64-13521 05-23)
(Contract AF 08(635)-1713)

A computer program (PICWICK) has been developed for the solution of the equations governing the viscoplastic model for hypervelocity impact. The program is capable of comparing various equations of state, flow-resistance coefficients, and fracture criteria. Some choices for these relations are briefly discussed, and the computational method on which the computer program is based is described. A series of calculated flowfields depicting iron-iron impact illustrate the bounded instability of the basic numerical scheme. That this problem may be overcome is then demonstrated by two series of flowfields calculated for lead-lead impact situations. The results show the rapidity with which the shock intensity decreases due to geometrical divergence and, consequently, lead to the conclusion that consideration of the pressures generated at impact cannot serve as a valid basis for neglecting target strength. Author

N64-13524 California U., Livermore. Lawrence Radiation Lab.
THE CALCULATION OF STRESS WAVES IN SOLIDS
Mark L. Wilkins and Richard Giroux *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 141–155 refs (See N64-13521 05-23)
(Contract W-7405-eng-48)

Finite difference techniques are used to solve the continuum equations in two dimensions with axial symmetry. The Tresca yield assumption is used in an equation of state that describes elastic, elastic–plastic, and hydrodynamic flow. Problems are presented where stress waves are induced in solids from the detonation of high explosives and from the impact of two materials. The effect of strength of materials on wave shapes and on exterior boundaries is shown as a function of time. Author

N64-13525 Naval Ordnance Lab., White Oak, Md.
A HYPERVELOCITY IMPACT MODEL FOR COMPLETELY DEFORMING PROJECTILES

J. L. Luttrell *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 157–161 (See N64-13521 05-23)

A simple mathematical model of crater formation by a hypervelocity impact has been developed. The model predicts the depth and duration of penetration into thick ductile targets by compact deforming projectiles which are small compared to the final crater volume. Author

N64-13526 Aberdeen Proving Ground, Md.
SPHERICAL SHOCK WAVES AND CAVITY FORMATION IN METALS

N. Davids, H. H. Calvit (Pa. State U.), and O. T. Johnson *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 229–271 refs (See N64-13521 05-23)

A theoretical and experimental study was made of the nonsteady motion of metallic spheres initiated by explosive blasts in a spherical cavity. The method of progressive waves is applied to determine the radius vs time diagrams of the propagation of the wave into the material and leads to values for cavity sizes. The assumptions are made that the material in the vicinity of the cavity possesses a polytropic equation of state, that entropy is constant for an element of material, and that the total energy is constant in time. The original partial differential equations of the problem are then reduced to a succession of ordinary differential equations. The solutions of the differential equation of progressive waves have been studied by constructing a solution diagram which is similar to a hodograph plane. An analysis is made of this plane and of the role played by the singularities of the differential equation. C.L.W.

N64-13527 Aro, Inc., Arnold Air Force Station, Tenn.
PROPERTIES OF SPHERICAL SHOCK WAVES PRODUCED BY HYPERVELOCITY IMPACT

Ray Kinslow *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 2, Pt. 1 Aug. 1963 p 273–320 refs (See N64-13521 05-23)
(Contract AF 40(600)-1000)

The distance within a solid at which the shock wave slows down to an elastic wave is considered as the radius of a "cavity" to the surface of which a forcing function can be applied to produce an elastic wave similar to that produced by the impact of a high-velocity projectile. By the use of a high-speed computer, the characteristics of the forcing function are found which will produce the same effects as those caused by a projectile. This forcing function can be described by a mathematical series, each term being of a form for which the general wave equation can be solved. This permits the computation of particle displacement, particle velocity, and principal stresses within the target. Author

N64-13528 General Electric Co., Valley Forge, Pa. Space Sciences Lab.
SHOCK FRONT VARIATION IN TIME FOR HIGH IMPACT INTO WATER

James F. Heyda *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963 Vol. 2, Pt. 1 Aug. 1963 p 321–336 refs (See N64-13521 05-23)

Consideration was given to the case in which a small material particle impacts a semi-infinite volume of water, bounded by a vertical wall, through a pre-punched hole in the vertical wall. Emphasis was placed on the development of an analytical procedure for determining the fluid particle velocity, density, and pressure behind the shock front, as well as the time variation of the shock. C.L.W.

N64-13545 Pratt and Whitney Aircraft, East Hartford, Conn.
TWO DIMENSIONAL ANALYSIS OF A HYPERVELOCITY IMPACT UPON A VISCO-PLASTIC PLATE

H. Kraus Mar. 1963 *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 13–40 ref (See N64-13543 05-01)

Previous, one-dimensional, analyses of this problem have assumed that no radial velocities are induced in a thin target plate by an impacting particle. They have also ignored variations of the axial velocity (and radial velocity) through the thickness. In this paper these restrictions are removed, and the results of a two-dimensional analysis of a hypervelocity impact upon a viscoplastic plate are presented. The radial velocities are found to be quite small when compared to the axial velocities except at the edge of the impact zone. Numerical results for the radius of separation obtained with the present theory are found to be less than those obtained in the previous theory because of differences in the manner of initiation of the impact process in the two analyses. Author

N64-13548 Aerojet-General Corp., Downey, Calif. Ordnance Div.
EFFECTS OF 3 TO 12 KM/SEC IMPACTS ON FINITE TARGETS

R. B. Mortensen, J. E. Ferguson, J. P. Joyce, and K. N. Kreyenhagen *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30 – May 2, 1963, Vol. 3 Aug. 1963 p 157–205 refs (See N64-13543 05-01)

This paper summarizes a series of experimental programs conducted to study hypervelocity impact and penetration phenomena for finite metal targets. Aluminum and titanium projectiles have been projected against 0.032- to 4.00-in.-thick aluminum targets at velocities from 3 to 12 km/sec. Photographs and curves show the observed relations between target hole sizes, crater shapes, etc. and the projectile variables. Effect of special projectiles such as long rods and thin foils is presented. Author

N64-13549 Bureau of Mines, Pittsburgh, Pa. Explosives Research Lab.
THIN PLATE PERFORATION STUDIES WITH PROJECTILES IN THE VELOCITY RANGE FROM 2 TO 5 KM/SEC

R. W. Watson, K. R. Becker, and F. C. Gibson *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 207–248 refs (See N64-13543 05-01)
(Sponsored by Army Dept.)

The major research effort was carried out with 2024-T3 aluminum targets using cylindrical steel projectiles having a length-to-diameter ratio of one. However, impacts on other target materials were also studied to delineate the effects of target strength and impact pressure. Particular emphasis was placed on determining the mass, number, and velocity distributions of the particles ejected from the rear surface of the target during the perforation process. Author

N64-13551 Air Force Systems Command, Eglin AFB, Fla.
THIN PLATE PERFORATION AND PROTECTION

Dale M. Davis *In* Firestone Tire and Rubber Co. Proc. of 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 387-391 (See N64-13543 05-01)

A summary is given of the papers presented at a symposium. The first three reports contain theoretical treatments of hydrodynamic impact into thin plates. The other papers treat areas such as empirical studies of penetration effects upon targets near the penetration limits of the projectiles, evaluation of spaced-plate protection techniques, chemical and mechanical sealants for structural vehicles, and the meteoroid threat to the success of the nuclear-rocket mission. C.L.W.

N64-13560 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneaux

GENERAL REMARKS ON THE PROBLEM OF SUSPENSION

J. Leclerc *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 22 p refs (See N64-13552 05-01)

The main object of aircraft suspension is to decrease the volume of flutter calculations by omitting from the calculations any coupling between vibrations and overall motions; such coupling is unusual in flight at critical speeds. In order to avoid coupling between natural modes on the ground, the natural frequency must be low. The easiest method of suspension investigated was the method of suspension by flexible rubber cords; apart from the observation of shapes of modes without displacement components, this method was felt to have the advantage of also allowing the experimental determination of the principal moments of inertia. When measuring moments of inertia, the disposition of the rubber cords must be elastically symmetrical about the three principal axes, and the frequencies of the various displacement modes must be low and well separated. R.T.K.

N64-13564 Massachusetts Inst. of Tech., Cambridge

THERMOELASTICITY

R. L. Bisplinghoff *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 52 p refs (See N64-13552 05-01)

The following topics are discussed: (1) elementary notions of thermoelasticity; (2) general statement of the equations of three-dimensional thermoelasticity; (3) an elementary thermal stress and distortion problem of practical interest; (4) variational principles of thermoelasticity; (5) plate thermoelasticity; (6) thermal buckling; and (7) stiffness and vibration frequencies of shell structures at elevated temperature. R.T.K.

N64-13566 Joint Publications Research Service, Washington, D.C.

DEVICE FOR MEASURING THE PHASE VELOCITY OF SURFACE WAVES

Yu. V. Kuznetsov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 p 1-7 refs (See N64-13565 05-01) OTS: $3.00

A method based on measuring the phase of a wave reflected from a moving load is described for measuring lag coefficient. An experimental measuring device is described and the errors of the device are evaluated by comparing the theoretical and experimental results. Author

N64-13573 Joint Publications Research Service, Washington, D.C.

DETERMINATION OF FORCED OSCILLATIONS IN NONLINEAR STABILIZING SYSTEMS

Yu. M. Khovanskiy, P. A. Severov, and V. S. Slepkov *In its* News of Higher Educ. Inst. Min. of Higher and Secondary Educ., USSR. Instr. Bldg. Ser., Vol. 6, No. 2, 1963 30 Dec. 1963 72-84 refs (See N64-13565 05-01) OTS: $3.00

An approximate method based on the use of logarithmic frequency characteristics is presented for determining the forced oscillations in nonlinear gyroscope stabilizing systems. A solution is given for the problem of finding the forced oscillations of a single-axle system of gyroscopic stabilization with the stabilizing motor having limited moment. Under these conditions, the appearance of a jumpwise resonance is possible. The results of the calculations are confirmed by modeling the system. Author

N64-13586 Joint Publications Research Service, Washington, D.C.

OPTICAL PROPERTIES OF OXIDIZED COMPOUNDS OF THE RARE EARTH METALS IN INORGANIC GLASS

Kan Fu-hsi, Chiang Chung-hung, and Ts'ai Ying-shih *In its* Transl. on Communist China's Sci. and Technol. No. 67 16 Jan. 1964 p 47-56 refs Transl. into ENGLISH from K'o-hsueh T'ung-Pao (Peking), no. 9, Sep. 1963 p 50-52 (See N64-13585 05-01) OTS: $1.50

A study was made of the effect of the oxidized compounds of rare-earth metals on the refractive index, the dispersion, and the angle of refraction of glass. Various oxidized compounds were added to simple sodium silicate glass. The chemical composition of the glass was $25Na_2O{\cdot}4TR_2O_3{\cdot}71SiO_2$. The refractive index, density, and angle of molecular refraction were obtained. Glass containing three valence oxidized compounds of rare-earth metals were compared, and the following principle of variation was noted—as the atomic number of the rare-earth elements increases, the density of the glass rises, and the molecular volume and the angle of molecular refraction drop. Charts giving the following information are also included: (1) the cubic unit-cell index; density, refractive index, and angle of refraction of the crystals of the oxidized compounds of rare-earth metals; (2) the refractive indexes of the rare-earth oxides, the sodium silicate crystals, and glass. R.T.K.

N64-13595 Massachusetts Inst. of Tech., Cambridge

SUPERCONDUCTIVITY IN THE NIOBIUM-TIN SYSTEM

Scientific Report No. 7

Ronald E. Enstrom May 1963 111 p refs

(Contract Nonr 1841(78); ARPA Order 214-62)

(AD-415847)

The critical current, critical temperature, and critical field of composite Nb-Sn wires and sintered Nb-Sn powder compacts of varying composition were found to depend on the properties and distribution of the phases present after heat treating at temperatures up to 1500° C. The temperature ranges of stability for Nb_3Sn, Nb_3Sn_2, Nb_2Sn_3, and a terminal solid solution of Sn in Nb were determined and a tentative phase diagram proposed. The transition temperature for Nb_2Sn_3 varies from 3.4° to 2.4° K and is associated with a solubility range of 60 to 65 a/o Sn noted for the compound, which has a critical field of 200 gauss at 2° K and a critical current ranging up to 2,500 amp/cm^2 at 2.2° K in zero field. The Nb solid solution has a critical field of 10,500 gauss and a critical current density of 4,400 amp/cm^2 at 2.2° K in a 10,000 gauss field. A systematic decrease in critical current density occurs with increasing heat-treating temperature for composite wires heat treated at temperatures above 1000° C for 6 minutes. Author

N64-13614 Stanford Research Inst., Menlo Park, Calif.
GRAPHICAL DATA PROCESSING RESEARCH STUDY AND EXPERIMENTAL INVESTIGATION Quarterly Progress Report 1, 1 Jun.-31 Aug. 1963
A. E. Brain and D. J. Hall Oct. 1963 39 p refs
(Contract DA-36-039-AMC-02347(E))
(Rept. 13; AD-425713)

The primary tasks are the construction of a 1,000-image optical preprocessor having its input derived from a television camera, and the development of techniques and equipment for applying the MINOS II learning machine to the processing of graphical data. A detailed analysis is presented of the problems associated with the design of the 1,000-image preprocessor. A structure using a storage tube, an array of plastic lenses, and cadmium sulphoselenide photoconductive cells is proposed. The most severe constraints are cost and the marginal level of illumination. The automatic training procedure, which is a significant technical development of MINOS II is analyzed in detail; both logical and electrical circuits are given. Author

N64-13616 Copenhagen U. (Denmark)
STUDIES IN CRYSTAL SPECTRA Final Report, 1 Sep. 1962-30 Aug. 1963
C. J. Ballhausen and C. R. Hare 1963 71 p refs
(Contract DA-91-591-EUC-2691)
(AD-424181)

The polarized crystal spectra of 15 crystals of transition metal complexes have been determined. Included were a series of nine hexacoordinated nickel complexes, three tetracoordinated nickel complexes, one crystal containing both hexacoordinated and tetracoordinated nickel, and two crystals of cobalt with a cis configuration. Splittings intensity distributions and transitions are observed. The results of the investigations are in agreement with available theory, and the classification assignments of the observed transitions are on this basis. C.L.W.

N64-13634 IIT Research Inst., Chicago, Ill.
OPTICAL SPECTRA USING THE MATRIX-ISOLATION TECHNIQUE Quarterly Technical Summary Report, 14 Aug.-14 Nov. 1963
[1963] 10 p refs
(Contact DA-31-124-ARO(D)-111; ARPA Order 458)
(IITRI-C6013-2; AD-425466)

Final testing of the matrix-isolation equipment was completed, and preliminary spectra of lithium fluoride, aluminum fluoride, and lithium metaborate were observed. Author

N64-13665 Air Force Cambridge Research Labs., Bedford, Mass.
INTERFERENCE PROPERTIES OF PHOTONS
David W. Ross Nov. 1963 24 p refs
(AFCRL-63-788; AD-425480)

The Brown–Twiss photon-correlation effect is discussed in purely quantum-mechanical terms. It is shown that for states incoherent in the sense that the phase of the electric field component at each frequency is unknown, Bose commutation relations imply the existence of intensity beats at all the difference frequencies. This result does not depend on lack of knowledge of the number of photons at each frequency; the beats are obtained even if the state is known to be an n-photon one. This derivation is compared with the classical theories of Brown and Twiss, and Purcell. A discussion is also given of interference in spatially localized states. Author

N64-13678 Joint Publications Research Service, Washington, D.C.
THE 2.6-m MIRROR REFLECTOR IMENI AKADEMIK G. A. SHAYN
B. K. Ioannisiani *In its* New Methods in Astronomy 10 Jan. 1964 p 11–18 Previously Published in Opt.-mekh. Prom. (Leningrad), no. 4, 1958 (See N64-13676 05-01) OTS: $3.00

Basic problems and considerations preceding the adoption of certain construction features of the 2.6-m telescope are discussed. P.V.E.

N64-13684 Joint Publications Research Service, Washington, D.C.
PHOTOELECTRIC METHOD OF STUDYING THE INSTABILITY OF STELLAR IMAGES
I. P. Rozhnova and Yu. A. Sabinin *In its* New Methods in Astronomy 10 Jan. 1964 p 76–85 refs (See N64-13676 05-01) OTS: $3.00

A photoelectron method of studying stellar images is described which is an attempt to create a more objective method of studying the vibrations of stars for the purposes and needs of automation. The method is as follows: The image of a star is set on the top of a four-sided prism (angle of inclination of the sides is 45 degrees). The prism is mounted so that the axes of its base coincide with the equatorial coordinates (hour angle and declination) of the telescope. In the unit four photomultipliers are used, each of which is installed opposite a corresponding side of the prism. From the load resistances of the photomultipliers signals go to preamplifiers which have amplification factors of 10^3. If the star is located exactly on the optical axis of the telescope, identical light fluxes are reflected from all four sides of the prism. With the slightest departure of the star from the optical axis, an imbalance of the circuit occurs which is proportional to the magnitude of the departure of the star from the optical axis. P.V.E.

N64-13686 Joint Publications Research Service, Washington, D.C.
CAMERA WITH AN OPTICAL COMPENSATOR FOR OBSERVING ARTIFICIAL EARTH SATELLITES
Kh. I. Potter and Yu. S. Streletskiy *In its* New Methods in Astronomy 10 Jan. 1964 p 120–115 refs (See N64-13676 05-01) OTS: $3.00

A method is described which makes possible the observations of artificial earth satellites with an accuracy approaching the accuracy of observations of stellar objects. P.V.E.

N64-13691 Joint Publications Research Service, Washington, D.C.
INTERFERENCE POLARIZATION FILTER FOR ASTROPHYSICAL INVESTIGATIONS OF THE SUN IN THE K LINE OF IONIZED CALCIUM
S. B. Ioffe and N. M. Drichko *In its* New Methods in Astronomy 10 Jan. 1964 p 153–154 (See N64-13676 05-01) OTS: $3.00

A test model interference-polarization filter (IPF), using ADP (dihydro phosphate of ammonia) synthetic crystals and some quartz crystals, is discussed. The use of this relatively cheap (due to the use of synthetic crystals) IPF will allow the equipping of the chromospheric telescopes in solar service stations with IPF's, so that the K line along with the H_α line can be observed. P.V.E.

N64-13725 Richard D. Brew and Co., Inc., Concord, N.H.
ULTRASONIC ECHO PATTERNS Final Report
D. J. Whitney May 1963 61 p refs
(Contract DA-19-020-ORD-5483)
(WAL-TR-143.5/2; AD-419113)

Ultrasonic echo patterns in circular glass plates, from centrally located voids of various sizes and shapes, were measured using a method of photoelastic detection which does not disturb the field being measured. The frequencies were selected to yield measurement for void sizes representing approximately 1.0, 3.0, and 10 ultrasonic wavelengths. A longitudinal plane wave, generated by a transducer bonded to the periphery of the blank, was made to strike the void; angular patterns of reflected waves were measured for both longitudinal and transverse waves. For rectangular voids, patterns were measured for incident angles of 0°, 15°, 30°, and 45° relative to the major surface of the void. Analysis is made of signal-to-noise ratio determining the minimum detectable signal, and the effect of random strains in the material on the accuracy of the measurements. The results are presented in the form of 27 polar plots of reflected level in terms of decibels down from the incident signal. Author

N64-13732 Joint Publications Research Service, Washington, D.C.
ELECTRON DIFFRACTION AND X-RAY PHOTOGRAPHIC INVESTIGATION OF OXIDE FILMS ON NIOBIUM
I. I. Korobkov, B. N. Revyakin, and Chen' Khe-Min *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 64–78 refs (See N64-13726 05-01) OTS: $3.00

The phase composition of oxides formed on niobium after oxidation in oxygen at a pressure of 150 mm/Hg in the temperature range between 400° and 1100°C was investigated using electron diffraction and X-ray photographic techniques. The results show a more or less pronounced difference in the structure of the oxide films firmly bonded to the metal as compared to niobium oxides which have already flaked off the specimen. A mixture of the alpha and beta phases of Nb_2O_5 was observed in the oxide films formed in the temperature range 700° to 900°C. As the temperature is increased above this range, the amount of alpha phase Nb_2O_5 in the film decreases and the amount of beta-Nb_2O_5 increases. M.P.G.

N64-13739 Joint Publications Research Service, Washington, D.C.
INSTALLATION FOR THE X-RAY STRUCTURAL ANALYSIS OF RADIOACTIVE MATERIALS
Yu. I. Gribanov, A. G. Karmilov, and I. A. Lednev *In its* Soviet Res. in Production and Phys. Met. of Pure Metals 10 Jan. 1964 p 146–162 refs (See N64-13726 05-01) OTS: $3.00

Consideration was given to the operating principles of the currently known installations used in the structural analysis of radioactive materials, and to the study of the mechanism of radiation disruptions in the crystalline lattice of metals and alloys. C.L.W.

N64-13743 Army Missile Command, Huntsville, Ala. Electromagnetics Lab.
AN ANALYSIS OF THE ACQUISITION OF RADIOMETRIC DATA ON LOW ALTITUDE AIRBORNE TARGETS
Dale E. Holter and harold L. Bates 15 Nov. 1963 84 p refs
(RE-TR-63-26; AD-426381)

The purpose of this report is to acquaint the reader with the objectives and techniques of an effective target radiation measurement program. It summarizes those weak points which have severely limited the effectiveness of past programs. Suggestions and guidelines for a successful program are discussed, and recommendations for future work in this area are made. Author

N64-13759 Sheffield U. (Gt. Brit.)
DECAY OF THE TRIPLET STATE Final Technical Report
G. Porter and J. W. Hilpern 30 Sep. 1963 39 p refs
(Grant AF-EOAR-62-113)
(AFCRL-63-923; AD-427019)

The decay of the triplet states of naphthalene, 2-bromonaphthalene, anthracene, 1,5-dichloroanthracene, and 9-bromophenanthrene have been studied in isopentane solution over the temperature range 22° to −80° C corresponding to a variation in viscosity by a factor of 10^8. An experimental arrangement for flash investigations at low temperatures is described. When allowance is made for discontinuities in the viscosity–temperature relationships, all the measurements are accounted for in terms of two regions of triplet decay—a high-viscosity region where rate is nearly independent of temperature and viscosity and the mechanism is truly unimolecular, and a low-viscosity region where diffusion-controlled quenching processes are operative. Author

N64-13760 Columbia U., New York, N.Y.
SURFACE WAVE GUIDING AND RADIATING SYSTEMS Scientific Report No. 80
S. P. Schlesinger, P. Diament, and V. L. Granatstein Mar. 1963 92 p refs
(Contract AF 19(604)-3879)
(CU-25-62-AF-3879-EE; AFCRL-63-522; AD-426997)

The following topics are discussed: (1) reformulation and solution of Maxwell's equations for general linear media; (2) radially inhomogeneous cylindrical structures; (3) waveguiding properties of an open plasma column; (4) the V-Line as a waveguiding structure; (5) the V-Line as a radiating structure; (6) ferroelectric materials; and (7) measurement and computation techniques—an open-cavity technique for determining ferroelectric properties under bias at microwave frequencies, and computation of integrals involving Bessel functions. R.T.K.

N64-13764 Air Force Systems Command, Wright-Patterson AFB, Ohio Aero Propulsion Lab.
AN ANALYSIS OF THE EFFECT OF IONIZATION ON THE LAMINAR FLOW OF A DENSE GAS IN A CHANNEL
Henry R. Velkoff Oct. 1963 99 p refs
(RTD-TDR-63-4009; AD-427273)

The analysis seeks to provide an explanation for the unusually high pressure drops found in previous experiments involving laminar flow of ionized gas with an applied electrostatic field. The analysis revealed that very high pressure drops could be expected and that velocity profile distortions would occur. Good correlation with test data was achieved. A new nondimensional parameter, called the charge number, was introduced. Charge number is related to the Knudsen number and is the controlling parameter for ion action in the gas stream. The conclusion from this work is that ions bound electrically to a flow stream set up an internal field on the stream, and then tend to resist the motion of the stream. This action causes profile distortions and increases effective fluid friction. Author

N64-13765 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
EXPERIMENTAL STUDY OF CONTACT THERMAL RESISTANCES

H. Cordier (Poitiers U.) 20 Dec. 1963 19 p refs Transl. into ENGLISH by JPRS from Ann. Phys. (Paris), no. 1–2, 1961 p 5–19
(RSIC-116; AD-426976)

Studies were undertaken to investigate the influence of the various mechanical and thermal parameters on the value of contact resistance. The first results obtained in investigation of the influence of the contact pressure are discussed. This experimental study has permitted the derivation of a few simple laws relating to the influence of pressure on contact thermal resistance. It was shown that when a discontinuity is subjected to rapid variations of pressure, the resistance may assume any value between two limits, which depend on the maximal pressure previously experienced by the discontinuity. These limits can be attained only when the compression and decompression cycles are carried out between zero pressure and the maximum pressure. When the pressure is invariable, the contact resistance evolves slowly with time, and tends toward a new limiting value between the two preceding limiting values. C.L.W.

N64-13771 Parke Mathematical Labs., Inc., Carlisle, Mass.
ENERGY STRAGGLING IN A SERIES OF ABSORBING LAYERS Scientific Report No. 1
Nathan Grier Parke III, Wentworth Williams, Jr., and Charles H. Sherman Nov. 1963 23 p refs
(Contract AF 19(628)-2419)
(AFCRL-63-558; AD-426775; Rept. 2419-SR-1)

The Landau theory of energy straggling has been extended to provide a method of calculating straggling distributions for a beam of charged particles which has penetrated more than one layer. With this method, the common experimental situation in which a beam penetrates several absorbing layers before entering the material under study can be handled almost as easily as the case of one layer. The approximations involved are consistent with the Landau theory, and the results are valid for thin layers. Author

N64-13774 Air Force Special Weapons Center, Kirtland AFB, N. Mex.
CALCULATION OF HIGH-ENERGY SECONDARY ELECTRON EMISSION
Jerry A. Sawyer Aug. 1963 173 p refs
(AFSWC-TDR-63-50; AD-419306)

Thin targets of low atomic number were assumed to be bombarded with 25-Mev electrons, 600-kv X-rays, and prompt fission gamma radiation. The resulting high-energy secondary electrons were calculated theoretically on a high-speed digital computer with respect to their intensity, energy losses, energy spectra, and angle of emission spectra. The results show that 25-Mev electrons, 600-kv X-rays, and prompt fission gamma radiation produce a maximum efficiency of high-energy secondary-electron emission of 8.0, 0.05, and 0.3 percent, respectively. Experimental results from 25-Mev electron irradiations agree very closely with these theoretical numbers. Author

N64-13775 Emerson and Cuming, Inc., Canton, Mass.
H-WAVES ON AN ANISOTROPIC DIELECTRIC SLAB Final Report
E. J. Luoma and S. J. Mason Oct. 1962 59 p refs
(Contract AF 19(628)-463)
(AFCRL-62-776; AD-411259) OTS: $5.60

Calculations were carried out on an IBM-7090 data-processing system, and the results are in the form of tables and plots of propagating wavelength versus frequency, with the longitudinal and transverse dielectric constants of the slab as parameters. The results show that a transverse dielectric constant only slightly larger than unity, together with a large longitudinal dielectric constant, yields a propagation wavelength only slightly less than that in free space over a wide frequency range. Hence such a structure may be of interest in the design of surface-wave antennas. Author

N64-13790 Sylvania Electric Products, Inc., Williamsville, N.Y. Sylvania Electronic Systems-Central
ELECTRONICALLY STEERABLE ARRAY FOR SPACE VEHICLE APPLICATIONS
Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 79 p refs
(Contract AF 30(602)-3041)
(RADC-TDR-63-463; AD-426844)

Progress is reported in the following areas: (1) The study of collimating devices is concluded, and characteristics are given in a table. (2) The scattering analysis has been completed for an array of scattering elements. (3) Work was continued on the ferrite steering analysis with the major effort concentrated on impedance matching. (4) The diffraction grating analysis has been started, and the properties of two types of grating structures are given. This is followed by a consideration of the fabrication of a variable grating in terms of the control mechanism and materials. Author

N64-13803 Naval Research Lab., Washington, D.C. Solid State Div.
A FAR INFRARED BIBLIOGRAPHY
E. D. Palik Apr. 1963 56 p refs
(NRL-Bibl.-21; AD-407047) OTS: $1.50

This bibliography covers research accomplished during the years 1889 through 1962. Among the subjects included are instrumentation and techniques, optical properties of gases, optical properties of liquids, and optical properties of solids. Also included is a graph of the growth of far-infrared research. R.T.K.

N64-13813 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
DIAGRAM I-x FOR A STEAM-HYDROGEN SYSTEM
Anatol Seletsky and Aleksander Blyum 17 Dec. 1963 11 p refs Transl. into ENGLISH from Khim. Prom., (Leningrad), v. 5, 1960 p 411–413
(RSIC-106; AD-426829)

A steam-hydrogen diagram was constructed using an oblique-angled system of coordinates, proposed first by Ramsay and later by Mollier, for moist air. The diagram is plotted on the basis of a constant pressure of 760-mm mercury column and on the basis of the equations of state of ideal gases in a temperature range from 0 to 1.8 kg/kg of dry hydrogen. Lines of constants of temperature (t), heat content (I), moisture content (x), relative moisture (ϕ), and constant temperature of the hygrometer (psychrometric lines) are plotted on the diagram. Information concerning the accuracy of the diagram is included. R.T.K.

N64-13834 Duke U., Durham, N.C.
REMARKS ON THE RELATIVISTIC KEPLER PROBLEM II. AN APPROXIMATE DIRAC–COULOMB HAMILTONIAN POSSESSING TWO VECTOR INVARIANTS
L. C. Biedenharn and N. V. V. J. Swamy [1962] 24 p refs
(Supported by Army and NSF)

The Dirac–Coulomb Hamiltonian is shown to contain a "fine structure interaction" which, when removed, defines a new Hamiltonian differing from the Dirac–Coulomb Hamiltonian in order $(\alpha z)^2/|x|$. The solutions of this new Hamiltonian, as well as its complete set of invariant operators, are

explicitly given. This "symmetric Hamiltonian" possesses a larger symmetry group than the R_4 group structure of the non-relativistic Coulomb Hamiltonian. The simplicity of the complete orthonormal set of solutions of the symmetric Hamiltonian lends itself to several useful applications which are briefly indicated. The relation between the solutions of this new Hamiltonian and the Sommerfeld-Maue-Meixner-Furry (S-M-M-F) wave functions is discussed. Author

N64-13896 Rochester U., N.Y.
THEORETICAL STUDIES OF THE ELECTROMAGNETIC FIELD IN THE FOCAL REGION OF COHERENT LIGHT BEAMS Progress Report No. 2, 1 Apr.-30 Sep. 1963
Emil Wolf [1963] 6 p refs
(Grant DA-ARO(D)-31-124-G-325)
(AD-427695) OTS: $1.10

Research activities were conducted in the following areas: electromagnetic diffraction in the focal region of an aplanatic optical system; stochastic theory of photoelectric detection of light fluctuations; statistical properties of light; and the quantum theory of interference effects produced by independent light waves. C.L.W.

N64-13904 Rochester U., N.Y.
ON THE ELECTROMAGNETIC VIOLATION OF CONSERVATION OF VECTOR CURRENT
Riazuddin 9 Nov. 1963 25 p refs Submitted for Publication
(Contract AT(30-1)-875)
(URPA-16)

The electromagnetic violation of vector current conservation is considered, and the strong interaction renormalization of the β-decay coupling constant, G_v, in the presence of electromagnetism was estimated. Results indicate that the existing discrepancy between the G_v and the μ-decay coupling constant G_μ may be due to such a renormalization. In order to demonstrate this effect, use is made of a hypothetical scalar particle with isotopic spin unity. This particle was used as an auxiliary means, and the final results did not depend on the parameters of such a particle. The particle had interactions with other particles only if the electromagnetic mass splitting of the isotopic multiplets was not neglected. Other properties of the particle are also discussed. R.T.K.

N64-13921 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
IONIZATION OF HYDROGEN ATOM NEAR THE THRESHOLD
V. Veldre, Ye. Iolin, and E. Karule 9 Oct. 1963 7 p Transl. into ENGLISH from Latvijas PSR Zinatnu Akad. Vestis (Riga), no. 6 (179), 1962 p 67-71
(FTD-TT-63-868; AD-424865)

The solution of the problem of hydrogen atom ionization by an electron impact is reduced to solving a system of integro-differential equations. Consideration is given to ionization near the threshold, and through a series of systems of equations the energy of the incident electron of less than 18 to 19 ev is calculated. C.L.W.

N64-13923 France. Ministère de l'Air, Paris
OUR UNIVERSE IN A FOUR DIMENSIONAL SPACE UNITARY THEORY [NOTRE UNIVERS DANS UN ESPACE A QUATRE DIMENSIONS SPATIALES. THEORIE UNITAIRE]
Jean Loiseau Serv. de Doc. et d'Inform. Tech. de l'Aeron. (SDIT), 1963 215 p refs In FRENCH
Its Publ. Sci. et Tech. 398) Available from SDIT, 2 Ave. de la Porte-d'Issy, Paris (15e)

This book contains chapters on: (1) methods employed for the geometric representation of space with particular emphasis on the work of Riemann and d'Élie Cartan; (2) a definition of time and a study of the motions of a point in remote fields according to the method of extremals and Cartan's integral invariant, modified to include the fact that space is "Riemannian" at four dimensions; (3) an illustration of the more general equations of remote electromagnetic and gravimetric fields with respect to space; (4) the presentation of a rational theory of mechanical wave motion; (5) a treatment of the cosmology of the universe, which is either expanding or contracting; (6) a study of the topological properties of space through the representation of a Riemann four-dimensional space on a space locally Euclidean with four dimensions; and (7) a comparison of the mechanics of Riemann space with its four-dimensional coordinates with the mechanics of Newton, and a discussion of limited and general relativity and their applications. Trans. by I.v.L.

N64-13940 National Bureau of Standards, Boulder, Colo.
CALCULATIONS OF THE FIELD NEAR THE APEX OF A WEDGE SURFACE
James R. Wait and Carolen M. Jackson 21 Nov. 1963 77 p refs
(NBS-TN-204) GPO: $0.45

Using the exact series solution for diffraction by a perfectly conducting wedge, numerical results are presented for the structure of the field in the apex region. This provides insight into the nature of electromagnetic fields near a surface discontinuity. The results provide some justification for employing approximate boundary conditions that have been used previously in studying radio propagation over terrain features. Author

N64-13942 Advisory Group for Aeronautical Research and Development, Paris, France
NOISE AND ITS EFFECT ON AIRCRAFT OPERATION
G. M. Coles Jan. 1963 24 p FRENCH summary
(AGARD-433)

The two main forms of engine noise—jet noise and compressor noise—are reviewed. In the in-flight operation of a particular aircraft, the three factors most significantly affecting community noise level are altitude, airspeed, and power setting. As each of these factors affects each form of noise generation in a different way, a considerable investigation of possible takeoff techniques must be carried out in order to achieve the maximum community benefit from special procedures. Author

N64-13944 Atomic Energy Research Establishment, Harwell (Gt Brit.)
THE PRODUCTION OF MAGNETIC FIELDS BY SUPERCONDUCTORS
D. A. Watt 1963 30 p refs
(AERE-M-1207) Available form HMSO: 4s

Summaries of information on the properties of superconductors and their application to the production of magnetic fields are given, with use of a wide selection of recent papers. Author

N64-13951 Virginia Polytechnic Inst., Blacksburg
TIME-DEPENDENT SOLUTION OF THE NEUTRON TRANSPORT EQUATION IN A FINITE SLAB Quarterly Progress Report, Sep.- Dec. 1962
Robert L. Bowden, Jr. (Ph.D. Thesis) Jan. 1963 137 p refs
(Contract AT(40-1)-2686)
(TID-18884)

The solution of an initial-value problem involving the one-velocity, time-dependent neutron transport equation in slab geometry is presented. The method of solution is based on the normal-mode expansion of K. M. Case, and uses the existence theorems of J. Lehner and G. M. Wing. The general (linear) neutron transport equation is formally reduced to the one-velocity, isotropic-scattering transport equation, and plane and azimuthal symmetry is assumed. I.v.L.

N64-13955 Little (Arthur D.) Inc., Cambridge, Mass.
SUPERCONDUCTIVE EFFECTS IN THIN FILMS Interim Engineering Report No. 5, 15 Jan.-15 Apr. 1963
S. Shapiro 15 May 1963 27 p refs
(Contract AF 33(657)-7915)
(C-64380; AD-425659)

The present report covers an applied research program in which determining the feasibility of performing electronic functions by making use of the phenomenon of electron tunneling between superconductors has been the chief object. Improvements were made in the measurement of microwave cavity Q. A CW local oscillator beating against the FM signal klystron generates a band of beat frequencies. A tunable radio receiver selects the desired narrow band. After shaping by an RC circuit, this band is used to trigger a pulse generator resulting in a pair of very sharp markers separated by a controllable and accurately measurable amount in frequency. Thus the bandwidth of the cavity characteristic can be accurately determined leading to a much improved Q measurement. Efforts were made to prepare low-resistance tunneling crossings with thin Al and Sn films. Stability with time of such crossings was poor. By using gaseous anodization and thick Sn films, low-resistance crossings with slow enough growth curves for experimentation were formed. Author

N64-13964 Toronto U. (Canada) Inst. of Aerophysics
NONEQUILIBRIUM EXPANSION FLOW OF DISSOCIATED OXYGEN AROUND A CORNER
I. I. Glass and A. Takano Jun. 1963 170p refs
(Grant AF-AFOSR-5441)
(UTIA-91; AD-426849)

The nonlinear partial differential characteristic equations were solved on an IBM-7090 computer for a number of cases with different free-stream conditions and wall deflection angles. Of special interest is the flow generated by a shock wave moving at a Mach number of 12 into pure oxygen at a pressure of 20 mm Hg, producing a degree of dissociation of about 20 percent at a temperature of about 3,700° K. It was assumed that at these temperatures the vibrational energy is in equipartition with those of translation and rotation, with the exception of the very corner, where the degree of dissociation and the vibrational excitation are assumed as frozen at their upstream values. Consequently, the partially frozen characteristic lines play the most dominant role in the present analysis. It was found that the flow produced by the corner consists of seven basic flow areas. The existence of a recombination shock wave at the tail of the expansion wave has been verified. Author

N64-13980 Brown U., Providence, R.I.
A NOTE ON THE SATISFACTION OF BOUNDARY CONDITIONS BY THE SPECIFIC INTENSITY IN PROBLEMS OF RADIATION GASDYNAMICS
Ira M. Cohen Aug. 1963 10 p refs
(Contract NOw-62-0604-C; Contract Nonr-562(35))
(AD-425986)

An approximation for an optically thin medium and Rosseland's approximation for an optically thick medium are used to examine the manner in which the specific radiant intensity satifies radiation gas-dynamic boundary conditions. I.v.L.

N64-13984 Wayne State U., Detroit, Mich.
THEORETICAL INVESTIGATIONS ON THE LIGHT SCATTERING OF SPHERES. XV. THE WAVE LENGTH EXPONENTS AT SMALL α-VALUES Technical Report No. 8 (54)
Wilfried Heller 20 Dec. 1963 21 p refs Submitted for Publication
(Contract Nonr 3511(00))
(AD-426133)

Both theoretical and empirical expressions are derived for the wavelength exponent of lateral scattering and turbidity expected for isotropic nonabsorbing spheres which are small compared to the wavelength ($\alpha \leq 1.5$). Use of these equations eliminates the need of interpolations between Mie data previously given or the computation of Mie data for small α-values not considered before ($\alpha<0.4$). The data cover all m-values ≤ 1.33. Reasons are given for their prospective usefulness in investigating spherical or quasi-spherical scattering bodies of unknown low concentration located at large distances from the observer. Author

N64-13991 Carnegie Inst. of Tech., Pittsburgh, Pa.
ON OBLATE NUCLEAR DEFORMATIONS
Krishna Kumar (Ph.D. Thesis) and Michael Baranger Dec. 1963 10 p refs
(Contract Nonr-760(15))
(Tech. Rept. 14; AD-425793)

Calculations of nuclear shapes, in a region of nuclear deformation among neutron-deficient isotopes in the vicinity of Ba in the periodic table, were performed based on the pairing-plus-quadrupole model of nuclear forces. One of the results shows that these nuclei have large intrinsic quadrupole moments and, in addition, these quadrupole moments are negative, i.e., the nuclei are oblate, or diskshaped. This was an unexpected result since all strongly deformed nuclei known thus far have prolate shapes, i.e., positive quadrupole moments. I.v.L.

N64-13992 New York U., N.Y.
RESEARCH IN FUNDAMENTAL PARTICLE PHYSICS Final Report, 1 Sep. 1962-31 Aug. 1963
Malvin A. Ruderman Oct. 1963 13 p refs
(Grant DA-ARO(D)-31-124-G356)
(AROD-2800-12; AD-425858)

The research activities reported include the following: (1) the properties of a superconductor in a weak external magnetic field; (2) relativistic two-dimensional field theory models; (3) calculation of the upper limits to the neutrino charge radius and to any possible neutrino magnetic moment or charge; (4) the collective behavior of superdense matter in which the Fermi energy is relativistic; (5) the electromagnetic interaction of the neutrino; (6) the representations of the trilinear commutation relations of Volkov and Green (parastatistics) in terms of multiplets of field satisfying the canonical commutation relations; (7) a search for a significant approximation to the many particle structure of scattering at high energies; (8) an S-matrix theory calculation of the nucleon as a bound state of a pion and nucleon; and (9) the generalization of the trilinear commutation relations between kinematically related field variables, which form the basis of field quantization for half-integral and integral spin fields, respectively, to the case of kinematically unrelated field variables. R.T.K.

N64-14021 Library of Congress, Washington, D.C. Aerospace Information Div.
LUMINESCENCE OF COMPLEX MOLECULES. ANNOTATED BIBLIOGRAPHY BASED ON SOVIET OPEN LITERATURE Report No. 1 [Jan. 1-Dec. 1962]
30 Dec. 1963 77 p 145 refs
(AID-B-63-125; AD-427157) OTS: $7.60 ph, $2.51 mf

The following areas are included: (1) luminescence of complex molecules—lifetime of excited states and quantum yield of luminescence; (2) luminescence of complex molecules—physical status and conversion of energy levels; and (3) applications of luminescence. R.T.K.

N64-14027 California Inst. of Tech., Pasadena Hydrodynamics Lab.
TORSIONAL MAGNETOELASTIC WAVES IN A CIRCULAR CYLINDER
M. E. Fourney and A. T. Ellis Dec. 1963 39 p refs
(Contract N123(60530)31686A)
(E-118.3; AD-426947)

The effect of an electromagnetic field on the propagation of a pure torsional elastic wave in a conducting circular cylinder is investigated. The general field equations and boundary conditions are linearized, and the equations of motion for an infinitely long circular rod are obtained for the particular electromagnetic field configurations considered. The torsional motion of a solid rod in a steady axial magnetic field with and without a steady electric field is considered, as well as the torsional motion of a hollow rod in a steady tangential magnetic field with and without a steady axial electric field. Author

N64-14029 Lincoln Lab., Mass. Inst. of Tech., Lexington
PROPERTIES OF DIELECTRICS FROM REFLECTION COEFFICIENTS IN ONE DIMENSION
H. E. Moses and C. M. de Ridder 11 Jul. 1963 51 p refs
(Contract AF 19(628)-500; ARPA Order 13; Proj. Defender)
(Tech. Rept. 322; AD-422444)

Mathematical techniques are presented for calculating dielectrics that give rise to prescribed reflection coefficients in certain problems of one-dimensional electromagnetic propagation. The techniques are, in principle at least, exact. They are based on the use of an equation of the Gel'fand–Levitan type for the one-dimensional Schrödinger equation. Author

N64-14031 Princeton U., N.J. Frick Chemical Lab.
ISOLATED HELICAL MACROMOLECULES
Arthur V. Tobolsky Dec. 1963 20p refs
(Contract Nonr-1858(07))
(AD-425881)

This report deals with the crystal structure and lattice energy of polymers of the polyethylene and polypeptide types. Emphasis is placed on the possible mechanisms involving postulated isolated, extended helical macromolecules (one-dimensional crystals) formed when polypeptides, proteins, and polynucleotides are dissolved. Also, the random coil configurations of synthetic polymers, such as nylon, polyethylene, isostatic polystyrene, etc., which are formed when these polymers are dissolved, are discussed. It is indicated that, at the present, no theory explains why isolated extended helical marcromolecules exist, or why they should be confined to polypeptides, proteins, and polynucleotides. I.v.L.

N64-14043 Columbia Radiation Lab., New York, N.Y.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Third Quarterly Progress Report, Jun. 16-Sep. 15, 1963
R. Novick 15 Sep. 1963 45 p refs
(Contract DA-36-039-SC-90789)
(AD-424139) OTS: $4.60

Precise measurements have been made of the zero-field hyperfine intervals in 14y Cd^{113m}, and a precise redetermination has been made of the lifetime of the $^3P1$ state of Zn. Apparatus is being constructed for the direct observation of the two-photon decay of the metastable ($2^2S_{1/2}$ state) of the helium ion. A double-resonance study of the hfs of two excited states of the chromium atom is in progress, and theoretical values have been obtained for the cross sections for laser quenching of metastable hydrogenic atoms. The ENDOR spectrum of the V_K center in LiF has been observed. The hfs interactions from the first and second lithium nearest neighbors and the first fluorine neighbors have been fully resolved. Doppler broadening of the Rayleigh scattered light from small plastic spheres has been observed with a laser homodyne spectrometer. The theory of photon echoes has been further developed, and it is shown that the radiation damping of the induced electric dipole moment is small enough to permit the observation of echoes. Microwave studies of the superconducting energy gap in zinc are continuing. High-pressure microwave absorption measurements have been made on mixtures of CO_2 and N_2. Author

N64-14048 Columbia U., Irvington, N.Y. Nevis Labs.
INTENSITY OF UPWARD MUON FLUX DUE TO COSMIC RAY NEUTRINOS PRODUCED IN THE ATMOSPHERE
T. D. Lee, H. Robinson, M. Schwartz, and R. Cool (Brookhaven Natl. Lab.) Jun. 1963 19 p refs
(Contract AT(30-1)-1932)
(NEVIS-115; CU-221; R-367)

Calculations have been performed to determine the upward-going muon flux leaving the earth's surface after having been produced by cosmic-ray neutrinos in the crust. Only neutrinos produced in the earth's atmosphere are considered. Rates of the order of one per 100 square meters per day might be expected if an intermediate boson exists and has a mass less than 2 Bev. Author

N64-14049 Joint Publications Research Service, Washington, D.C.
PROSPECTS FOR INCREASING THE RANGE OF HYDROACOUSTICAL MEANS OF SURVEILLANCE
A. L. Prostakov 24 Jan. 1964 12 p refs Transl. into ENGLISH of an article from Morskoi Sb. (Moscow), no. 11, 1963 p 67–74
(JPRS-22890; OTS-64-21385) OTS: $0.50

In order to increase the range of a hydroacoustical system, it is essential to increase the intensity of the useful signal and to decrease the intensity of interference at the point of reception. A survey of work being done in the area of increasing the range of hydroacoustical systems indicates that the problem is complex and depends on progress in the development of hydroacoustics as well as on progress in shipbuilding, electronics, oceanography, hydrology, and several other branches of science and technology. R.T.K.

N64-14050 Battelle Memorial Inst., Columbus, Ohio
POSTIRRADIATION RELEASE OF Xe^{133} FROM OXIDE CERAMICS

David L. Morrison, Thomas S. Ellerman, and Duane N. Sunderman 17 Oct. 1963 16 p refs
(Contract W-7405-eng-92)
(BMI-1651) OTS: $0.50

Postirradiation measurements were made at 700° to 1500° C of the release of Xe^{133} recoiled into alpha Al_2O_3, BeO, MgO, and ZrO_2 during neutron irradiation in contact with UO_2 powder. The release pattern from most of the specimens was identical: a high rate of loss of Xe^{133} for several minutes followed by a slower release for which the cumulative fractional release was linear with the square root of the heating time. Diffusion coefficients for Xe^{133} were calculated from the slope of the release curve following the burst. The magnitude of the diffusion coefficients was nearly the same for all the materials studied, and the activation energy for Xe^{133} release from alpha Al_2O_3 above 1000° C was found to be 64 kcal/g mole. The xenon release behavior was compared to anion diffusion in these oxides. Author

N64-14056 Los Alamos Scientific Lab., N. Mex.
STATUS REPORT ON OPACITY CALCULATIONS
Walter F. Huebner and Robert S. Stuart 7 Jan. 1964 77 p refs
(Contract W-7405-eng-36)
(LAMS-3002) OTS: $1.75

The results of a survey in the opacity field have been compiled and are categorized according to the various phases of an opacity calculation. The categories considered include: energy levels, wave functions, electronic occupation, bound-free transitions, free-free transitions, bound-bound transitions, scattering, molecular transitions, and complete opacity calculations. Author

N64-14057 Hanford Atomic Products Operation, Richland, Wash.
FIXED TIME ESTIMATION OF COUNTING RATES WITH BACKGROUND CORRECTIONS
W. L. Nicholson 20 Jan. 1964 211 p refs
(Contract AT(45-1)-1350)
(HW-76279) OTS: $3.00

A routine method is given for estimating the total radioactivity in a long-lived sample. It involves monitoring the sample with a detector for a fixed time period, t, recording the total number of counts, x, and calculating a counting rate, x/t. A background counting rate estimate, y/s, is also calculated for the same detector from a background count, y, recorded over a fixed time period, s. The background estimate, which supposedly represents all spurious activity, is subtracted to give the sample net counting rate estimate. C.L.W.

N64-14068 California U., Livermore. Lawrence Radiation Lab.
ANNOTATED BIBLIOGRAPHY OF THEORIES OF THE EQUATION OF STATE OF HIGH TEMPERATURE GASES
Stephen G. Brush 3 Jul. 1963 100 p refs
(Contract W-7405-eng-48)
(UCRL-6473, Suppl. 1) OTS: $2.25

Works on the theory of ionized gases and strong electrolyte solutions are listed. The scope includes temperatures down to about 2000° K and studies of the effects of pair production at very high temperatures. Investigations of the lowering of the ionization potential in a plasma, and the equilibrium concentrations of ions have also been included. C.L.W.

N64-14070 California U., Berkeley. Lawrence Radiation Lab.
ALPHA-DECAY STUDIES OF PROTACTINIUM ISOTOPES
Vishnu B. Subrahmanyam (Ph.D. Thesis) 22 Oct. 1963 74 p refs
(Contract W-7405-eng-48)
(UCRL-11082) OTS: $1.75

The alpha decay of Pa^{231}, Pa^{229}, Pa^{227}, and Ac^{223} is studied. The ground states of Pa^{227} and Pa^{229} are shown to be populated by 5.46- and 5.73-Mev α particles, respectively. The rotational bands populated in the decay of Pa^{227} are interpreted as being based on octupole vibrational levels predicted by the Bohr–Mottelson "strong-coupling" model. Modified decay schemes are presented. It is suggested that in odd-proton nuclei the permanent nuclear deformation starts closer to the closed shell than in the even-even nuclei. A new alpha group at 5.47 Mev is reported in the alpha decay of Ac^{223}. No rotational structure is observed in the levels populated. Evidence is presented for the presence of two additional levels populated in the alpha decay of Pa^{231} Author

N64-14071 Nihon U., Tokyo (Japan) Coll. of Science and Engineering
GROUND STATE ENERGY AND STABILITY PROBLEM OF A DEGENERATE ELECTRON GAS
Setsuo Misawa [1963] 13 p refs
(NUP-63-17)

Landau's theory of a Fermi liquid is applied to the examination of whether or not the paramagnetic, degenerate Fermi gas state always remains the lowest state, i.e., whether the Coulomb interaction ever results in a ferromagnetic state at any density. Also, a scheme for evaluating the ground state energy from this approach is presented. As the correlation function, which plays the most essential role in the Landau theory, the correlation form, as first used by Watabe, is employed. The usual r_s-expansion is never invoked throughout this paper. I.v.L

N64-14076 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
EFFECTS OF TRANSIENT NUCLEAR RADIATION ON TRANSDUCERS AND ELECTRICAL CABLES
F. D. Terry Natl. Reactor Testing Station, 30 Nov. 1963 36 p refs
(Contract AT(10-1)-205)
(IDO-16914) OTS: $0.75

This series of tests was conducted on behalf of the Spert program to determine the effects of high-peak-flux transient nuclear radiation on the performance of various types of transducers and electrical cables. Items included in the tests were ion chambers, thermocouples, flowmeters, velocity and pressure transducers, strain gages, and several types of electrical cables. This report contains a description of the tests and of the performance of all test items in transient nuclear fluxes of up to 1.9×10^{16} nv. Author

N64-14077 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
ANNUAL PROGRESS REPORT ON FUEL ELEMENT DEVELOPMENT FOR FY 1963
G. W. Gibson, M. J. Graber, and W. C. Francis 25 Nov. 1963 65 p refs
(Contract AT(10-1)-205)
(IDO-16934) OTS: $1.50

Program objectives included a materials study involving (1) development of new fuel compositions, (2) testing of newly developed aluminum alloys at high temperatures, and (3) determining damage thresholds in beryllium. Also included

have been prototype studies involving hydraulic, heat-transfer, and irradiation testing of improved fuel element geometries. Irradiation tests on powdered UAl_3 intermetallic compounds demonstrated good stability and fission gas retention capabilities. Developmental aluminum powder metal products showed good corrosion resistance at high temperatures while retaining excellent high temperature strength. All of the fuel compositions tested (UO_2, U_3O_8, and UAl_3 in aluminum matrices) exhibited density decreases under irradiation. Tensile tests on sandwich-type fuel plates at elevated temperatures indicate that the fuel plate strength is strongly influenced by the core material rather than dependent primarily on the cladding material as has been found true of lower (MTR) temperatures. Author

N64-14082 Georgia U., Athens
INFRARED SPECTRA OF PLASTICS AND ELASTOMERS AFTER NUCLEAR IRRADIATION Research Report For 1963
W. C. Sears 20 Dec. 1963 22 p refs
(Contract AT(40-1)-2418)

Research activities are summarized as follows: (1) Unirradiated Marlex 50 polyethylene and polybutene-1 films were melted in new, heated absorption cells to study the effects of melting and resolidification on their infrared spectra. Crystalline and amorphous bands were identified. (2) The g-value for transvinylene growth in polybutene-1 during irradiation was found to be approximately 0.03. (3) It was concluded that polybutene-1 has two crystalline forms, but the third form, reported by Zannetti et al., failed to exhibit infrared bands not found in the other two forms. (4) Irradiation of polybutene-1 apparently melted all crystallites in addition to forming different types of double bonds. I.v.L.

N64-14083 Atomics International, Canoga Park, Calif.
EMF MEASUREMENTS IN MOLTEN DIVALENT METAL-METAL HALIDE SOLUTIONS
L. E. Topol 30 Jan. 1964 18 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-881) OTS: $0.50

Potentiometric studies on concentration cells of the type C, $M(N_1)$, $MX_2(1-N_1)$ || $MX_2(1-N_2)$, $M(N_2)$, C, where M represents Hg, Cd, Pd, and Zn, MX_2 represents the halide, and N denotes the metal mole fraction, were made at various temperatures. Slopes of plots of the log metal concentration vs emf yielded apparent Nernst n values of 2 for Hg-$HgCl_2$ at 300° C and for Cd-$CdCl_2$ at 580° C. For Pb-PbI_2 apparent Nernst n values of about 2.2 to 2.3 were found at 585° C and 693° C; for Pb-$PBCl_2$ the low metal solubility made detection of an n value difficult, but a value of 2 appeared probable. No constant emf's were obtained in Zn-$ZnCl_2$ melts at 658° C and 695° C. The above n values of 2 indicate a two-electron reaction at the electrode and are consistent with the existence of metal atoms M or cation dimers M^{+2}. No evidence for the monomer ion M_2^{+2} was observed. Author

N64-14109 City Coll. of the City of New York Queens Coll.
THE PRINCIPLE OF EQUIVALENCE Technical Report No. 1
Dec. 1963 13p refs
(Grant Nonr(G)-00045-63)
(AD-427264)

Certain phenomena, which should be predictable on the basis of a principle of equivalence, but are not encompassed by the formulation of Rohrlich are discussed. It is concluded that one must distinguish between the principle of equivalence and the specific requirement on a theory in order that the principle be satisfied. This distinction is implicit in the statement of the principle by Einstein (1911) and his comment to Nordström. The statement might be made in the following way: In a sufficiently small region of a gravitational field, there exists a coordinate system in which the effect of the gravitational field on any physical process vanishes. For the useful special case of the static homogeneous uniform field, the region may be quite large; for the general case, this domain is vanishingly small. R.T.K.

N64-14113 Radio Corp. of America, Princeton, N.J.
TRACE ANALYSIS OF SOLIDS BY MASS SPECTROMETRY Scientific Report No. 1, 16 Apr. 1962-30 Sep. 1963
R. E. Honig Oct. 1963 65 p refs
(Contract AF 19(628)-446)
(AFCRL-63-530; AD-427414)

A double-focusing mass spectrograph has been modified and methods developed to permit the analysis of special solid samples. New ion sources have been developed that have a high intrinsic efficiency. A source has been developed that employs a laser beam for local heating to permit the analysis of microregions. Author

N64-14122 Naval Research Lab., Washington, D.C.
FEASIBILITY OF UTILIZING LUMINESCENT AND REFLECTIVE COATINGS AS VISUAL AIDS FOR NIGHT CARRIER LANDINGS
Gerald E. Rohl and Jack E. Cowling 15 Oct. 1963 14 p refs
(NRL-5973; AD-427228)

The studies included small-scale tests on models and intermediate-scale tests (about 1/4 scale) in a hangar. In each type of test, fluorescence was induced by two methods: (1) direct illumination of the surface by near-ultraviolet or visible red and blue energy; and (2) indirect illumination by white light of the under surface of a fluorescent paint applied to a clear plastic bar. The latter of these two methods appears to be technically feasible, and it is recommended that a full-scale evaluation be made. The high level of lighting required by the first method would seem to preclude its use for actual application aboard ship. Author

N64-14124 Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
ELEMENTARY SOURCE DESCRIPTION OF SCATTERING AND DIFFRACTION
Peter C. Waterman 23 Apr. 1963 87 p refs
(Contract AF 04(647)-305)
(RAD-TR-62-13; AD-425508)

By examining the physics underlying boundary conditions of any diffraction problem, a description of scattering is obtained which employs elementary point sources distributed over the obstacle. This description is valid everywhere in space, in contrast to usual procedures involving Green's theorem, which need not be employed. The elementary source concept leads naturally to two kinds of integral equations for the determination of scattering. In the first, the unknown field for a fixed incident plane wave is to be integrated over the surface or volume of the obstacle; in the second, the unknown field, at arbitrary fixed field point, is to be integrated over directions of incidence of an incident plane wave. This latter technique is most applicable to a class of obstacles meeting the geometrical requirement of enclosability. As an example of this method, the diffraction of an electromagnetic wave by an infinite strip is examined, and a solution is obtained which is valid for low frequencies and any direction of incidence normal to the axis of the strip. The theory developed provides new methods for the exact computation of the radar cross section of many types of target. Author

N64-14125 Massachusetts Inst. of Tech., Cambridge Aerophysics Lab.
AN ANALYTICAL INVESTIGATION OF CAVITY OSCILLATIONS
Eugene E. Covert Oct. 1963 6 p refs
(Contract Nonr 1841(79))
(MIT DSR-8951; MIT-TR-87; AD-422156) OTS: $1.10

Analytic studies of the stability of the flow past cavities filled with fluid were carried out. The problem was solved in the following way: Some particular fluid property was found in the upper half space in terms of the known distribution of that property over the boundaries and the unknown distribution over the opening. The same property was found in the cavity in terms of the distribution over the cavity boundaries and the opening. The two distributions were then equated at the opening. The resulting equation provided a means of computing the entire flow field, including its stability. Two cases were studied. One case was an acoustic cavity with energy storage in the fluid, and the other case corresponded to a hydroelastic cavity with energy storage in the cavity walls. The calculated results were in good general agreement with the experimental results. R.T.K.

N64-14135 Iowa State U. of Science and Tech., Ames
RELAXATION PHENOMENA IN THE ELECTRICAL DOUBLE-LAYER
Daniel Harrison Grantham and Robert S. Hansen Nov. 1962 101 p refs
(Contract W-7405-eng-82)
(IS-598) OTS: $2.25

After assembling an instrument capable of high sensitivity, a substitution technique was applied to investigate the frequency dependence of the double layer capacitance at the interface between mercury and aqueous electrolytic solutions for several polarizations of the mercury and for three temperatures. It was shown that the frequency dependence of both the capacitance and resistance was due to a distributed capacity effect analogous to that which is found in the transmission lines of communications engineering. An annulus was postulated to exist between the supporting glass sheath and the gold tube, at the end of which the flat mercury interface was formed. A complete frequency independence of the capacity and resistance was demonstrated for an interface between a mercury droplet and electrolytic solution. The droplet was extruded from a capillary of about 65 microns internal diameter having a hydrophobic inner wall. Application of Desicote to the inner wall was sufficient to prevent solution penetration between the glass of the capillary and the mercury thread and thus remove the source of the distributed capacity effect.
Author

N64-14144 Princeton U., N.J. Plasma Physics Lab.
LIFE TESTING OF A.C. HEATED TUNGSTEN FILAMENTS IN STRONG MAGNETIC FIELDS
G. Martin Oct. 1963 7 p refs
(Contract AT(30-1)-1238)
(MATT-229)

Two 3%-Re tungsten coiled filaments were placed in the magnetic field of the C Stellarator and successfully operated, under both pulsed and steady-state conditions, with 50-kc heater power at a temperature of 2350° K for over 2 months. When these filaments were subsequently examined, their surfaces were found to be slightly etched; however, their appearance was satisfactory in all other respects. They were found to be more resistant to fatigue effects than other filaments.
R.T.K.

N64-14145 Princeton U., N.J. Plasma Physics Lab.
MAGNETIC EFFECTS IN CERTAIN SYSTEMS OF CHEMICAL ENGINEERING INTEREST
F. W. Camp (Sun Oil) and E. F. Johnson Sep. 1963 47 p refs
(Contract AT(30-1)-1238)
(MATT-235)

This series of three articles presents analyses by which several magnetic effects may be evaluated. First, a magnetically induced shift of equilibria is investigated. The second article discusses magnetic effects on rate processes. Finally, in the third article the possible effects of magnetic field gradients are considered.
Author

N64-14151 Los Alamos Scientific Lab., N. Mex.
OTHER DETAILS OF POST-FISSION BETA DECAY
James J. Griffin 11 Jan. 1964 34 p refs
(Contract W-7405-eng-36)
(LA-2811, Addendum) OTS: $0.75

These details include the time dependence of average beta disintegration energies and the average number of beta decays for various nuclides, as well as plots of these quantities at certain specific times as a function of the single parameter $\bar{z}$, which characterizes the fissioning nuclide.
Author

N64-14157* University of Southern Calif., Los Angeles
ION BEAM NEUTRAL COMPONENT DETERMINATIONS BY RESONANCE RADIATION ABSORPTION
R. K. Cole, D. F. Hall, R. F. Kemp and J. M. Sellen, Jr. (Space Tech. Labs.) N.Y., Am. Inst. of Aeron. and Astronautics [1964] 55 p refs Presented at the AIAA Aerospace Sci. Meeting, New York, 20–22, Jan. 1964
(NASA Contract NAS8-1560)
(AIAA Paper-64-9; Rept. 8603-6038-KU-1000) AIAA: $0.50 members, $1.00 nonmembers

Resonance condition may be modified by several physical processes which must be considered in interpreting experimental data. Atomic spectral lines are often complex, having a detailed structure, each component of which may have a different absorption probability. The source of light may exhibit line broadening and self-absorption. The absorbing atoms may not be in resonance with the incident radiation because of the atoms' velocity or because of external electric and magnetic field. Therefore, a given photon, in general, can be absorbed by only a fraction of the neutral atoms of the same element. These problems are discussed and a transmission versus atom density curve predicted for radiation exhibiting atomic hyperfine structure, line broadening, and source self-absorption. A lamp and radiation detector system was calibrated by means of an absorption cell for both mercury and cesium. In addition, the mercury system was installed on an electron-bombardment ion thrustor, and the neutral atom density of the exhaust plasma measured. A neutral cesium atomic beam from a cesium oven was monitored by means of optical absorption.
R.T.K.

N64-14159 Battelle Memorial Inst., Columbus, Ohio
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING OCTOBER, 1963
Russell W. Dayton and Ronald F. Dickerson 1 Nov. 1963 77 p refs
(Contract W-7405-eng-92)
(BMI-1655(Del.)) OTS: $2.00

The following topics are included: (1) reactor materials and components; (2) studies of fuels; (3) general fuel-element development; (4) radioisotope and radiation applications; (5)

coated-particle fuel material—materials development program, fuel-irradiation program, and supporting research program; (6) corrosion studies of the fluoride-volatility process; (7) progress on long-term creep rupture program on SAP (sintered aluminum product) alloys, and mechanical properties of zirconium alloys; (8) fission-product deposition studies; (9) gas-cooled reactor program; and (10) joining of regenerative-cell components. R.T.K.

N64-14163 European Atomic Energy Community, Brussels (Belgium)
RECENT INVESTIGATIONS CONCERNING THE INFLUENCE OF NON-UNIFORM TEMPERATURE DISTRIBUTION IN DOPPLER EFFECT CALUCLATIONS
G. Blasser and W. Matthes Joint Nucl. Res. Center, Ispra Establ. (Italy), [Oct.] 1963 14 p refs Presented at the 8th Congr. Nucl., Rome, 17–23 Jun. 1963
(EUR-401.e) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 40 Belg. Fr.

To study the influence of nonuniformities in the temperature distribution inside fuel rods, the Doppler coefficient has been calculated by direct integration of the narrow-resonance formulas for a single resonance for a slab lattice. Also, a Monte Carlo method has been developed that allows the calculation of the total temperature coefficient of nonuniformly heated fuel in the region of unresolved resonances; in this method the details of the resonance structure are determined by sampling from the statistical level and widths-distributions. Preliminary results of both theories are presented. Author

N64-14164 California U., Berkeley. Lawrence Radiation Lab.
ON THE QUASI-PARTICLE INTERACTIONS IN SPHERICAL NUCLEI
Mannque Rho (Ph.D. Thesis) 21 Oct. 1963 188 p refs
(Contract W-7405-eng-48)
(UCRL-11080) OTS: $2.75

The residual terms that arise from the Bogoliubov–Valatin canonical transformation are studied in angular-momentum representation and applied to some low-energy properties of spherical nuclei. The treatment makes use of the conventional perturbation theory, and its objective is to clarify the roles that each of the interaction terms play. First, the Bardeen–Cooper–Schrieffer theory applied to finite nuclei is reexamined, with a constant-pairing-matrix element approximation (G). By use of the BCS solutions as the zero-order approximation, the effects of the residual terms on both even-A and odd-A nuclei are analyzed. The results obtained by applying our treatments to single-closed-shell nuclei ($N = 82$ and $52 \leq Z \leq 64$) show that for even-A nuclei, the term H_{22} is sufficient, and it appears that for odd-A nuclei, a first-order treatment of H_{31}, together with a complete account of the H_{22} term, gives good results. Author

N64-14165 California U., Berkeley. Lawrence Radiation Lab.
A NUMERICAL STUDY OF THE REGGE PARAMETERS IN POTENTIAL SCATTERING
Akbar Ahmadsadeh (Thesis) 30 Oct. 1963 158 p refs
(Contract W-7405-eng-48)
(UCRL-11096) OTS: $2.75

The threshold and asymptotic behavior of the Regge parameters are discussed, and some examples given. It is shown that the position and residue of the first trajectory of a single attractive Yukawa potential satisfy the dispersion relation expected when there are no intersections with other trajectories. An example is given of a repulsive Yukawa potential where the position of the pole does not satisfy such a dispersion relation. Examples are given of a simple superposition of attractive and repulsive Yukawa potentials for which the trajectories are similar to the relativistic case. By modifying the background integral, the Regge formula is rewritten to include the Born term and to make the background integral less significant. The Khuri series for the partial-wave amplitude has been modified to explicitly single out the Born term. The convergence of this series has been investigated for the case of a single Yukawa potential. Author

N64-14166 Hanford Atomic Products Operation, Richland, Wash.
QUARTERLY PROGRESS REPORT RESEARCH AND DEVELOPMENT PROGRAMS EXECUTED FOR THE DIVISION OF REACTOR DEVELOPMENT APRIL, MAY, JUNE, 1963
M. M. Hendrickson and J. K. Green, eds. Jul. 1963 136 p refs
(Contract AT(45-1)-1350)
(HW-78388) OTS: $2.50

The current status of a program is presented that includes studies on the basic properties of fuel materials and fabrication methods, physics, chemical processing of reactor fuels and radioactive wastes, materials development, irradiation effects on materials, fuel cycle analysis and advanced reactor concepts, instrumentation, and nondestructive testing techniques. I.v.L.

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-13477 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
FUNDAMENTAL INVESTIGATION OF NONSTEADY AND NONEQUILIBRIUM FLOW
G. Rudinger *In* Va. U. Project Squid 1 Oct. 1963 p 1–4 refs (See N64-13476 05-01)

This study deals with the extension of theoretical and experimental methods for the analysis of problems involving nonsteady and nonequilibrium flows. At present, two-phase flows are being investigated in which a gas carries along a large number of small particles that are evenly distributed over the cross section of a duct. The temperature and velocity of the particles cannot follow rapid changes of the conditions in the gas, and if the particles represent an appreciable mass fraction of the mixture, their response to the flow changes, in turn, affects the carrier gas. Considerable deviation from equilibrium may occur. Author

N64-13478 Johns Hopkins U., Baltimore, Md.
INVESTIGATION OF TURBULENCE
Leslie S. G. Kovasznay *In* Va. U. Project Squid 1 Oct. 1963 P 5-8 refs (See N64-13476 05-01)

Progress is reported in: (1) boundary-layer transition in which the experimental efforts are concentrated in the detailed flow field of the boundary-layer breakdown process due to a solitary localized disturbance; and (2) plasma turbulence, with most of the period being used to explore a new configuration of the Fowler shock tube which was used to measure shock-wave data. J.E.T.

N64-13479 Aeronautical Research Associates of Princeton, Inc., N.J.
FUNDAMENTAL STUDY OF DYNAMICS OF GASES AND PLASMAS
Guido Sandri, Roger D. Sullivan, Theodore F. Morse, and Edward A. Frieman *In* Va. U. Project Squid 1 Oct. 1963 p 9–12 refs (See N64-13476 05-01)

Brief content notes of five papers concerning the irreversible behavior of the kinetic and macroscopic regimes of gases are presented. J.E.T.

N64-13480 Brown U., Providence, R.I.
RESEARCH ON THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASES AT HIGH TEMPERATURES AND PRESSURES
J. Kestin, J. Ross, J. H. Whitelaw, A. Nagashima, R. DiPippo et al *In* Va. U. Project Squid 1 Oct. 1963 p 13–18 (See N64-13476 05-01)

Progress is reported in: the development and use of the first, second, and third torsional viscometers, tests of validity of present statistical theories of transport properties, construction of a capillary flow viscometer, a theory of viscosity of dense gases, and nonequilibrium molecular distributions and chemical kinetics. J.E.T.

N64-13481 Illinois U., Chicago
PROPERTIES OF TWO-PHASE FLOW—ELECTRIC PHENOMENA
S. L. Soo, J. A. Hultberg, G. J. Trezek, and R. C. Dimick *In* Va. U. Project Squid 1 Oct. 1963 p 19–21 refs (See N64-13476 05-01)

Measurements of thermal electrification of various solid particles (Cu, W, Fe, MgO, Al_2O_3, BN_2) with an argon plasma jet showed that thermal electrification enhances the electron concentration significantly, even for temperatures below the boiling point of these solids. For higher temperatures, the ionization of the vapor phase of these solids becomes obvious. However, as the jet is cooled down, the presence of solid particles increases the recombination rate of argon. In another experiment, the removal of electrons from a steady glow discharge by a jet of charged solid particles was shown by the extinction of the glow (zero discharge current); the glow is immediately restored when the solid particles are turned off. Measurements of concentration distributions of solid particles during the blowdown of a gas–solid suspension through a nozzle showed effects of aerodynamic forces as well as electrostatic forces. Author

N64-13482 Massachusetts Inst. of Tech., Cambridge
THERMAL CONDUCTIVITY OF GASES AND LIQUIDS OVER A RANGE OF TEMPERATURES AND PRESSURES
Frederick G. Keyes *In* Va. U. Project Squid 1 Oct. 1963 p 23–25 refs (See N64-13476 05-01)

The objective of this program is to make precise determinations of the thermal conductivity of various gases at temperatures up to about 700° C and over a wide range of pressures up to about 1,000 atm. Not only are experimental determinations made, but correlation and tabulation of a large fraction of the data in the literature are also underway. These results should enable confident extrapolation of the existing data into regions which are at present inaccessible to direct measurement. Author

N64-13483 Princeton U., N.J.
A STUDY OF FLUID FLOW WITH SUSPENDED PARTICLES
R. Eichhorn, J. Muir, U. Navon, and R. Shanny *In* Va. U. Project Squid 1 Oct. 1963 p 27–29 refs (See N64-13476 05-01)

This study is concerned with the characteristics of the flow of fluids with suspended particles including gaseous or liquid fluids and solid, liquid, or gaseous particles. Within this general scope, investigations are presently being made of gas (air) flowing horizontally through a constant area duct with solid particles in suspension and of the flow of a gas-liquid mixture (air bubbles dispersed in water) through a vertical variable-area duct. Author

N64-13484 California U., Berkeley
THEORY OF FAST REACTIONS
A. K. Oppenheim, R. W. Getzinger, and R. De Vogelaere *In* Va. U. Project Squid 1 Oct. 1963 p 31–34 refs (See N64-13476 05-01)

The role of vibrationally excited species produced in fast reactions is a central problem in modern chemical kinetics. Among possible reactive systems, pure ozone appears particularly attractive because of (1) the relative simplicity of its kinetics and (2) the known existence of vibrationally excited oxygen molecules in shocked ozone. Studies of steady detonation waves in ozone have been undertaken, and it is hoped that experimental data will reveal features of theoretical interest concerning reactions taking place in the range between 2000° and 3500° K. Author

N64-13485 Catholic U. of America, Washington, D.C.
KINETICS OF ELEMENTARY REACTIONS
B. deB. Darwent and A. L. Flores *In* Va. U. Project Squid 1 Oct. 1963 p 35–36 (See N64-13476 05-01)

This program is concerned with the investigation of the kinetics of elementary reactions involving hydrogen and fluorine. The objective is to obtain information about the kinetics and rate constants of reactions involving fluorine which are likely to be of importance in liquid-propellant rocket-propulsion systems. Author

N64-13486 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INVESTIGATION OF REACTION KINETICS IN HIGH-TEMPERATURE GASES
George H. Markstein *In* Va. U. Project Squid 1 Oct. 1963 p 37–43 refs (See N64-13476 05-01)

This study is concerned with kinetics and mechanisms of reactions in high-temperature gases. The specific systems now under investigation are reactions of metal vapors with oxygen. The methods employed in the work are suitable adaptations of the dilute-diffusion-flame techniques that have been successfully used for other reacting systems. Author

N64-13487 Humble Oil and Refining Co., Baytown, Tex.
REACTIONS OF IONS AND ELECTRONICALLY EXCITED SPECIES WITH ATOMS AND MOLECULES IN THE GAS PHASE
J. L. Franklin, F. H. Field, and M. S. B. Munson *In* Va. U. Project Squid 1 Oct. 1963 p 45–49 (See N64-13476 05-01) (Contract Nonr-3623)

The program has been devoted largely to studies of ion-molecule reactions in light hydrocarbon gases at pressures up to about 300μ in the ion source of the mass spectrometer. A detailed study of reactions between methane and hydrogen has been completed, and experimental data have been obtained for ethane, propane, and the two butanes. Author

N64-13488 Stanford Research Inst., Menlo Park, Calif.
CHEMICAL KINETICS AND GAS DYNAMICS OF ATOM AND FREE-RADICAL REACTIONS

Henry Wise, Clarence M. Ablow, Yapa Rajapakse, Dan Schott, and Bernard J. Wood *In* Va. U. Project Squid 1 Oct. 1963 p 51–57 refs (See N64-13476 05-01)

The research program deals with the transport properties and reaction kinetics of labile species, such as atoms, free radicals, and ions, which may be of importance in advanced propulsion systems. The studies include: (1) interaction of atoms with solid surfaces, (2) kinetics of homogeneous atom recombination, and (3) transport properties of reacting gases. An electrodeless discharge (radiofrequency and microwave) is employed for the production of atoms by dissociation of the molecular gas. The progress of reaction, either homogeneous, heterogeneous, or both, is monitored by means of electron spin resonance (ESR) and microcalorimetric techniques under steady-state conditions. Author

N64-13489 Virginia U., Charlottesville
INELASTIC MOLECULAR COLLISIONS
John E. Scott, Jr., Douglas G. Griffith, Jesse H. Heald, and John A. Phipps *In* Va. U. Project Squid 1 Oct. 1963 p 59–62 refs (See N64-13476 05-01)

This research program is concerned with the examination of inelastic collision phenomena using molecular beam techniques. The gas phase interaction of colliding atomic or molecular species is to be examined for those collisions in which sufficient energy is supplied, such that a rearrangement of atomic bonds takes place. An aerodynamic molecular beam source is being evaluated experimentally in order to demonstrate that a nearly isoenergetic beam of neutral particles of large intensity can be achieved. A mass spectrometer will be used to detect the products of inelastic collisions, and reaction cross sections are to be determined as a function of the energy available in the center of mass of the collision system. Author

N64-13490 Atlantic Research Corp., Alexandria, Va.
SOLID-PROPELLANT FLAME MECHANISMS
R. Friedman, A. Macek, and J. M. Semple *In* Va. U. Project Squid 1 Oct. 1963 p 63–65 refs (See N64-13476 05-01)

The objective of this program is to gain basic information pertinent to solid-propellant combustion mechanisms by studying combustion of single metal particles (aluminum or beryllium) injected into flame gases of known temperature and composition. Author

N64-13491 Massachusetts Inst. of Tech., Cambridge
MAGNETOHYDRODYNAMICS OF PARTIALLY IONIZED GASES
James A. Fay, W. C. Moffatt, R. L. Leonard, M. Sajben, and J. B. Workman *In* Va. U. Project Squid 1 Oct. 1963 p 67–70 refs (See N64-13476 05-01)

At present the efforts of this group are devoted to basic theoretical and experimental studies of the important physical phenomena arising in magnetohydrodynamic-propulsion and power-generation machines. The theoretical investigations are centered on a study of the unsteady wave motion in the presence of electric and magnetic fields. The experimental portion of the work is focused on the utilization of combusion-driven shock tubes to duplicate in the laboratory those conditions of gas velocity, temperature, density, and electrical conductivity which might prevail in an actual device. Author

N64-13492 Minnesota U., Minneapolis
ENTHALPY FLUCTUATIONS IN PLASMA JETS
Perry L. Blackshear, Jr., Dah Yu Cheng, Gordon O Voss, Hai Wu, William H. Kuretsky et al *In* Va. U. Project Squid 1 Oct. 1963 p 71–82 refs (See N64-13476 05-01)

This program describes work on probes used in high-temperature gases to deduce temperature and velocity variations in time and space. The basic instrument employed consists of a transpiration cooled nozzle (which dilutes and cools the sampled plasma), an instrumentation chamber (a small volume, isolated by flow restrictions, which fills and empties in approximately 1/5000 sec), and instrumentation (either a fast-response heat-flux meter or a thermocouple). A knowledge of the diluent temperature, the temperature of the mixture, and the ratio of diluent to sample gases gives the information required to compute the sample enthalpy. Porous graphite has been used in several versions of the probe, but the nozzle failed rapidly when it came in contact with the highly excited gas cone in the argon plasma flame. A method of pressing stainless-steel powder to form a porous convergent–divergent shell has been developed, and the performance of these nozzles in probes immersed in the plasma flame has been evaluated. Preliminary experience with the Greyrad probe and the Raezer Olsen intermittent thermometer is described. J.E.T.

N64-13621 California U., Berkeley Electronics Research Lab.
SOME MICROWAVE-FREQUENCY EXPERIMENTS WITH AN ELECTRON-BEAM-INDUCED PLASMA [Interim Report]
D. J. Harra 22 Jul. 1963 43 p refs
(Contract AF 19(628)-324)
(Rept. 63-16; Sci. Rept. 24; AFCRL-63-381; AD-426212)

The microwave-frequency aspects of a system composed of an electron-beam-induced plasma are studied, and the various phenomena associated with the system are described. Three classes of oscillations, together with propagation in the forward- and backward-wave modes of the plasma, were investigated. The limitations of the experimental apparatus are discussed, and the corresponding improvements are suggested for future experiments. Author

N64-13657 Westinghouse Electric Corp., Pittsburgh, Pa.
SUPERCONDUCTING MAGNET RESEARCH AND APPLICATION MHD POWER GENERATORS Final Report [1 Feb.–31 Oct. 1963]
R. R. Akers, W. A. Stewart, T. C. Tusu, R. E. Kothman, and O. T. Beecher Wright-Patterson AFB, Ohio, Aero Propulsion Lab., 31 Dec. 1963 376 p refs
(Contract AF 33(657)-10567)
(RTD-TDR-63-4170; AD-426776)

A suitable superconducting magnet-MHD generator system is developed which includes the solution of the following problems: (1) winding configuration; (2) field strength and field variations; (3) stress and magnetic-force support structures; (4) heat-rejection radiators; (5) cryogenic and high-temperature cooling; (6) stored-helium cooling; (7) refrigeration and insulation; (8) superconductor properties; (9) magnet protection; (10) losses in the MHD process due to field strength and field variations. Optimum techniques and parameters are investigated for all components. This subsystem is then combined with state-of-the-art estimates of specific weights for developed turbine generator systems. These estimates give a final plant specific weight for a one megawatt electrical generator, operating on a Rankine cycle and utilizing zinc as the working fluid. This system is then optimized with respect to magnetic field strength and field homogeneity. Author

N64-13663 ARO, Inc., Arnold Air Force Station, Tenn.
SUMMARY OF ELECTRICAL PROPULSION DIAGNOSTIC INSTRUMENTATION

James B. Whited Arnold Eng. Develop. Center, Jan. 1964 40 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-63-242; AD-426835)

This report summarizes the instrumentation development effort that was initiated to effect plasma diagnostics during the long-term testing of electrical propulsion systems. Two different ion-beam sources were instrumented to obtain the basic properties of the plasma, such as the electron temperature, electron and ion densities, and the space charge potentials. The basic instrumentation required to effect preliminary diagnostics are the "plasma eater," the positive ion probe, the Langmuir double probe, the Faraday cup, and the emissive probe. With these devices, it is possible to obtain both integral and differential measurements of the beam characteristics. Analysis of the data is included. Author

N64-13669 Miami U., Coral Gables, Fla.
COOPERATIVE EFFECTS AND PLASMA LOSSES IN A MAGNETIC FIELD Final Report, 1 Mar. 1962-28 Feb. 1963
Behram Kursunoglu [1962] 24 p
(Contract AF 19(604)-8082)
(AFCRL-63-775; AD-426192)

Diffusion of electrons and ions in a plasma across a magnetic field with the interplay of an anisotropic dynamical friction is formulated in terms of the methods of Brownian motion. For a special symmetry of the dynamical friction matrix it is found that for Larmor periods of the order of the relaxation time across the magnetic field, the diffusion takes place as an ordinary Brownian motion uninhibited by the external magnetic field. Author

N64-13786 Microwave Associates, Inc., Burlington, Mass.
MILLIMETER WAVE COMPONENT DEVELOPMENT (BEAM-PLASMA AMPLIFIER)
Paul Chorney Griffiss AFB, N.Y., RADC, Dec. 1963 27 p refs
(Contract AF 30(602)-2948)
(RADC-TDR-63-477; AD-427059)

Probe measurements are described which show that the plasma column of the PIG discharge has a nonuniform axial density profile. Experiments are also described in which plasma densities of 3×10^{14} cm^{-3} are measured with a discharge current of 1 amp in xenon gas at 98 m torr. Other measurements obtained from this tube are in disagreement with the previous tube. The theory of electron beam scattering is examined, and it is found that electron–atom collisions have a larger effect than electron–ion collisions. Mean-free-paths of several centimeters are predicted for beam electrons in a beam-plasma system having 50 percent ionization and a plasma density of 10^{15} cm^{-3}. From theoretical studies, it is concluded that highly ionized plasmas are desirable for amplifier applications because of the longer mean-free-paths that exist. Author

N64-13787 Philco Corp., Blue Bell, Pa.
SOLID-STATE APPLICATION STUDY
M. Heil, S. T. Fisher, and P. M. W. Nave Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 123 p refs
(Contract AF 30(602)-3037)
(RADC-TDR-63-493; AD-427093)

The objective of this contract is to conduct a theoretical and experimental investigation of the plasma-like properties of the charge carriers in solid-state materials in order to determine the feasibility of utilizing this pseudoplasma for amplification and generation of electromagnetic energy. The following types of waves are considered: (1) slow transverse electromagnetic waves (helicon waves and extensions thereof), (2) longitudinal electric waves (plasma waves), and (3) fast transverse electromagnetic waves. Helicon waves are theoretically capable of being amplified in semiconductors at frequencies of the order of 10^7 cps or lower. Longitudinal plasma-wave instabilities remain of great interest, but have never been observed in semiconductors. Fast wave amplification is not possible in the case where the d.c. magnetic field, the d.c. electric field, and the wave vector $\vec{k}$ are mutually parallel, and where a shifted Maxwellian is assumed for the velocity distribution function. Author

N64-13788 Microwave Associates, Inc., Burlington, Mass.
MAGNETICALLY CONTROLLED GAS DUPLEXER
C. S. Ward Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 33 p refs
(Contract AF 30(602)-2960)
(RADC-TDR-63-500; AD-427100)

Experimental studies have shown that magnetic fields do not produce any significant reduction in discharge arc loss for pressures in the millimeter range. The recovery-time problem in a magnetic field has been analyzed in terms of microwave transmission through a magnetized plasma slab. Plotted computer results are compared with experimental data. Author

N64-13791 Cornell U., Ithaca, N.Y.
INVESTIGATION OF NEW CONCEPTS FOR MICROWAVE POWER GENERATION. PLASMA STUDIES Final Report
L. F. Eastman et al Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 229 p refs
(Contract AF 30(602)-2833)
(RADC-TDR-63-465, Vol. 1, Final; AD-427003)

CONTENTS:

1. A TEST VEHICLE FOR THE STUDY OF THE INTERACTION OF A HIGH-POWER ELECTRON BEAM WITH A PLASMA L. F. Eastman, D. Kerr, H. Marantz, Y. Narayan, and J. J. Clark (Cornell Aeron. Lab., Inc.) 53 p refs (See N64-13792 05-24)
2. ANALYSIS OF THE INTERACTION OF AN ELECTRON BEAM WITH A PLASMA H. Marantz 81 p refs (See N64-13793 05-24)
3. PLASMA DIAGNOSTICS D. M. Kerr 43 p refs (See N64-13794 05-24)
4. ION-INDUCED OSCILLATIONS OF ELECTRON BEAMS A. S. Gilmour, Jr. 43 p refs (See N64-13795 05-24)

N64-13792 Cornell U., Ithaca, N.Y.
A TEST VEHICLE FOR THE STUDY OF THE INTERACTION OF A HIGH-POWER ELECTRON BEAM WITH A PLASMA
L. F. Eastman, D. Kerr, H. Marantz, Y. Narayan, and J. J. Clark (Cornell Aeron. Lab., Inc.) *In its* Invest. of New Concepts for Microwave Power Generation. Plasma Studies Dec. 1963 53 p refs (See N64-13791 05-24)

The design construction, and preliminary experimental results of a test vehicle for studying plasma–electron beam interaction are discussed. Two connected chambers of the test vehicle, one at hydrogen pressures as high as 10^{-3} torr for generation of plasma and the other at pressures less than 10^{-5} torr for the generation of a high-power electron beam in a convergent flow gun, are described. Author

N64-13793 Cornell U., Ithaca, N.Y.
ANALYSIS OF THE INTERACTION OF AN ELECTRON BEAM WITH A PLASMA
H. Marantz (M.S. Thesis) *In its* Invest. of New Concepts for Microwave Power Generation. Plasma Studies Dec. 1963 81 p refs (See N64-13791 05-24)

A detailed analysis is made of the gain characteristic of the beam–plasma amplifier. The first section is a study of the general specification of a plasma and of the d.c. plasma discharge in particular. It is found that the analysis of the low-pressure Penning discharge must take particle streaming under consideration to account for the discharge current and the percentage of ionization. The second section analyzes several mechanisms for broadening the gain characteristics of an infinite beam plasma. It is concluded that the beam–plasma inhomogeneities account for the greatest change in the gain characteristic. Corrections for plasma collisions and temperature can be neglected for the experimental values expected.
Author

N64-13794 Cornell U., Ithaca, N.Y.
PLASMA DIAGNOSTICS
D. M. Kerr *In its* Invest. of New Concepts for Microwave Power Generation. Plasma Studies Dec. 1963 43 p refs (See N64-13791 05-24)

The design and use of singly reentrant cavities in an electron-beam hydrogen-plasma system are described. The cavities serve as the input and output coupling structures of a beam-plasma amplifier and, in addition, they are used to investigate the properties of the plasma discharge. Perturbation of resonant cavity by a plasma is discussed, and equations are obtained relating the shifts in resonant frequency and cavity Q to the average electron density and collision frequency. Some typical experimental results are given, and a linear relationship is found between resonant frequency shift and discharge current.
Author

N64-13795 Cornell U., Ithaca, N.Y.
ION-INDUCED OSCILLATIONS OF ELECTRON BEAMS
A. S. Gilmour, Jr. *In its* Invest. of New Concepts for Microwave Power Generation. Plasma Studies Dec. 1963 43 p refs (See N64-13791 05-24)

From measurements and from published data, it is concluded that transverse oscillations increase in amplitude with time because of interaction after the electrons enter the magnetic focusing field. Radial oscillations were found to occur at a frequency that was 1.4 to 2 times the transverse frequency. They increase in amplitude with time because, accompanying the oscillation of the ion core, there is a density modulation of the ions in the core that affects the focusing of the electron beam in the convergent Pierce gun in a periodic manner. This causes the diameter of the electron beam to oscillate, which in turn, causes the radial oscillations of the ions to grow.
Author

N64-13826 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
INVESTIGATIONS IN GASEOUS ELECTRONICS Final Report
Robert R. Pepper 30 Oct. 1963 43 p refs
(Contract AF 19(604)-7216)
(AFCRL-63-519; PIBMRI-1195-63; AD-426467)

Various diagnostic methods for the analysis of approximately uniform plasma in a pulsed discharge have been studied. For microwave diagnostics it was desirable to use a rectangular cross section instead of a circular one. The results have been compared with analysis based on uniform and sinusoidal electron density contours. Estimates were obtained in this way of the electron collision frequency in hydrogen; the best value is $\nu = 2.3\ 10^9\ \mathrm{sec}^{-1}$ as a pressure of 2 torr. A program of spectroscopic studies was also carried out. It was found that the Stark splitting is a very useful tool in studying the formation of the discharge. A new phenomenon was discovered in which the discharge can propagate back along the cathode cylinder.
Author

N64-13838 Hughes Aircraft Co., Culver City, Calif.
ADMITTANCE OF WAVEGUIDE RADIATING INTO PLASMA ENVIRONMENT Scientific Report No. 6
A. T. Villeneuve Bedford, Mass., AF Cambridge Res. Labs., Oct. 1963 42 p refs
(Contract AF 19(604)-8386)
(AFCRL-63-540; P63-73; AD-425956)

This report investigates the changes in input admittance of a rectangular waveguide terminated in a groundplane covered by a uniform plasma slab contiguous with the groundplane. Such radiators provide wide angular pattern coverage and find application as telemetry and communication antennas in reentry vehicles. Numerical calculations have been performed for the case of lossless plasmas in which the electron densities are all below the critical density, i. e., the effective relative permittivity of the slab ranges between zero and unity. Curves of input conductance and susceptance for this configuration are given as a function of relative permittivity for several slab thicknesses. These admittance values are used to compute reflection coefficients and signal loss resulting from mismatch. The calculations show that, except for thin slabs, the aperture admittance is very close to that for a slab of infinite thickness.
Author

N64-13901 Sandia Lab., Albuquerque, N. Mex.
THE HYPERSONIC PLASMA CONVERTER: I
K. J. Touryan Jan. 1964 37 p refs
(SC-4960(RR)) OTS: $0.75

Theoretical and experimental analyses are presented that describe the operation of the hypersonic plasma generator known as ASP (Aerodynamic Supply of Power). Previous investigations are reviewed, corrected, and summarized. Additional information is introduced to bring the present status of the generator up to date.
Author

N64-13917* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Tapco Div.
RESEARCH ON THE VORTEX MHD POWER GENERATOR Final Report, [Apr. 1962–Jul. 1963]
W. C. Davis et al Jul. 1963 165 p refs
(NASA Contract NAS3-2526)
(NASA CR-55310; ER-5453) OTS: $12.00 ph, $5.15 mf

The investigation of turbulent vortex flow was supported both analytically and experimentally. Analytical models, based on a pseudolaminar analysis and in analogy with turbulent boundary layers, were developed for the hydrodynamics of turbulent jet-driven vortex flows with and without centerbodies. A dual jet vortex-type MHD generator was operated in the laboratory on cesium-metal-seeded arc-heated argon plasmas. Heat transfer and thermal control were established consistent with original estimates. A computer analysis for determining the performance of the vortex generator was developed. Real gas effects, including external heat transfer and viscous drag on the vortex sidewalls, were thereby included in the calculation of overall generator performance. The computer analysis was applied to the example of a high-temperature-combustion plasma-operated vortex MHD generator; the generator performance was shown to be very competitive with other types of strongly competing open-cycle power conversion systems.
Author

N64-13919 Air Force Systems Command Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF THE LANGMUIR PROBE METHOD FOR INVESTIGATING DEIONIZING PLASMA
V A. Ivanohenko 20 Feb. 1963 14 p 3 refs Transl. into ENGLISH from Izv. Nauchn. Issled. Inst. Postoyan. Toka (Moscow), no. 7, 1961 p 5–13
(FTD-TT-62-1734; AD-299650) OTS: $1.60

The probe characteristics of a deionizing plasma were shown to differ in principle from that of a plasma with a fixed potential. The following topics were considered: (1) conditions of utilizing probe characteristics for investigating a deionizing plasma; (2) error in determining the plasma potential; (3) error in determining the electron temperature; and (4) obtaining probe characteristics of a periodically deionizing plasma. R.T.K.

N64-13930 Sandia Corp., Albuquerque, N. Mex.
A METHOD FOR OBTAINING RADIAL DISTRIBUTIONS FROM OPTICAL MEASUREMENTS ON CYLINDRICAL PLASMAS
W. B. Brooks and G. E. Reis Dec. 1963 18 p refs
(SC-4938(RR))

A method of inverting Abel's integral equation is described that is fairly insensitive to experimental errors. The method approximates the radial distribution by a series of Gaussian distributions; hence the accuracy is best in problems such as gas columns, where Gaussian distributions might be expected. Author

N64-14059 Weapons Research Establishment, Salisbury (Australia)
EXCESS ENERGY ELECTRONS
E. H. Hirsch Oct. 1963 47 p refs
(CPD-71)

If electrons from an auxiliary source are injected into a Penning-type electrode structure, some of the electrons gain anomalous energy, enabling them to reach electrodes which are strongly negative with respect to the emitting cathode. The energy distribution and number of these excess energy electrons, which can constitute the major portion of current flow, are studied as functions of the discharge parameters. Comparison with observations of anomalous electron scattering in glow discharges not using magnetic fields suggests that the phenomena are related. The energy transfer mechanism involved may account for the apparent Maxwellian distribution of plasma electrons, and may constitute the explanation of the Langmuir paradox. Author

N64-14064 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
COLLISION INDUCED DISSOCIATION RATES IN THERMAL PLASMAS
C. Frederick Hansen [1964] 9 p refs Presented at the AIAA Aerospace Sci. Meeting, N. Y., 20–22 Jan. 1964
(AIAA Paper 64-55) AIAA: $0.50 members, $1.00 nonmembers

Collision-induced dissociation rates for diatomic and triatomic molecules are estimated from a version of the available energy theory. The collision is assumed to excite one mode of internal momentum in an unbounded Boltzmann distribution, and the number of energy modes used in the dissociation process is taken to be the number of internal modes that disappear when the molecule breaks apart. This model is found to agree with available experimental data, generally within a factor of 10, over a wide range of temperature and for a wide variety of collision partners. Author

N64-14117 Polytechnic Inst. of Brooklyn, N.Y., Microwave Research Inst.
RADIATION FROM A DIPOLE IN AN INFINITE, HOMOGENEOUS, ANISOTROPIC PLASMA
E. Arbel (Ph.D. Thesis) and L. B. Felsen 25 Sep. 1962 44 p refs
(Contract AF 19(604)-4143)
(PIBMRI-1070-62; AD-415388)

A previously derived solution is specialized here to the study of the radiation field due to an electric current dipole in an infinitely extended, homogeneous anisotropic plasma. The asymptotic field solution is interpreted in terms of rays along which energy propagates from the source to the observation point. The number of contributing rays, varying from zero to four, depends on the constitutive parameters and is determined by the refractive index curves for the medium. Special attention is given to transition phenomena associated with refractive index curves that have points of inflection or unbounded branches. A set of representative radiation patterns has been calculated. Author

N64-14118 Sylvania Electronics Systems, Waltham, Mass. Applied Research Lab.
ADMITTANCE OF ANNULAR SLOT ANTENNAS RADIATING INTO A PLASMA LAYER Scientific Report No. 3
Janis Galejs Aug. 1963 26 p refs
(Contract AF 19(628)-2410)
(AFCRL-63-395; AD-425302)

The slot admittance is calculated for a slot radiating into a waveguide of radius 5 λ to 10 λ. The radius of the wide waveguide is selected so that the slot admittance is equal to the admittance for a semi-infinite half space in the absence of plasma. This slot admittance is an approximation to the admittance of an inhomogeneous half space in the presence of a plasma layer. The calculated slot susceptance is shown to be nearly constant for various thicknesses of the plasma layer, while the slot conductance and radiation conductances are decreased by increasing plasma thickness. This approximate calculation appears to be particularly good for thin layers of electrically contrasting plasma ($\epsilon_p/\epsilon_o \neq 1$ and/or $\tan \delta_p > > 1$). The calculations indicate an admittance similar to that of earlier calculations for a rectangular slot radiating into a wide rectangular waveguide. Author

N64-14119 Westinghouse Electric Corp., Pittsburgh, Pa.
LONG LIFE CLOSED LOOP MHD RESEARCH AND DEVELOPMENT UNIT Final Rept., 15 Mar. 1962–15 Oct. 1963
R. L. Hundstad, F. A. Holmes, J. G. De Steese, W. S. Emmerich, R. E. Voshall et al Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Oct. 1963 155 p refs
(Contract AF 33(657)-8311)
(ASD-TDR-63-4019; AD-427297)

A closed loop MHD generator and motor research unit has been designed and built to produce MHD conditions and gain experience in the operation of MHD generators suitable for space applications. Component parts of the machine were individually tested before assembly. After assembly the first test used helium and cesium as the working fluid. Future plans include tests with different vapors and duct materials together with the incorporation of nonthermal ionization and possibly superconducting magnets. Author

N64-14139 Northwestern U., Evanston, Ill. Gas Dynamics Lab.
TABLES OF THERMODYNAMIC PROPERTIES OF ARGON, NITROGEN, AND OXYGEN PLASMAS

K. S. Drellishak, D. P. Aeschliman, and Ali Bulent Cambel
Arnold Eng. Develop. Center, Jan. 1964 570 p refs
(Contract AF 40(600)-972)
(AEDC-TDR-64-12; AD-427839)

The thermodynamic properties of oxygen and nitrogen plasmas at various pressures and temperatures are presented. Also included are the thermodynamic properties of argon plasma at a pressure of 0.01 atmospheres. Author

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-13427 Technical Operations, Inc., Burlington, Mass.
INVESTIGATION OF COHERENT OPTICAL PROPAGATION
Thomas J. Skinner *In its* Invest. of Coherent Optical Propagation Tech. Doc. Rept. Nov. 1963 p 1–70 refs (See N64-13426 05-01)

The need for a knowledge of the coherence of the emission of a laser in the design of a ground-to-satellite-to-ground optical communication system is described. In addition, methods, both theoretical and experimental, for measuring this coherence are presented. The signal and noise powers to be expected at various locations along the communications path are presented, but the effects of the atmosphere are ignored. A theoretical model of the propagation of light intensity and coherence in the atmosphere is developed. The results of this theoretical analysis along with some experimental data are used to repeat the previous power analysis, but the effects of the atmosphere are included. A general evaluation of the communications channel is given. Author

N64-13428 Air Force Cambridge Research Labs., Bedford, Mass.
DIFFRACTION OF PARTIALLY COHERENT LIGHT BY A PLANE APERTURE
George B. Parrent, Jr. and Thomas J. Skinner *In* Tech. Operations, Inc. Invest. of Coherent Optical Propagation Tech. Doc. Rept. Nov. 1963 10 p refs Repr. from Opt. Acta (Paris), v. 8, no. 1, Jan. 1961 p 92–102 FRENCH and GERMAN summary (See N64-13426 05-01)

Using the formulation of coherence theory as introduced by Wolf, the diffraction of partially coherent light is discussed. The mutual coherence function and the intensity distribution are computed for a plane slit illuminated by coherent, partially coherent, and incoherent light. The results are plotted and discussed. Author

N64-13433 Johns Hopkins U., Baltimore, Md.
ORIENTED SOLIDS
J. L. Ericksen *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 37–57 refs (See N64-13431 05-01)
(Supported by NSF and Army Res. Office)

Roughly, a continuum theory of oriented materials is one which ascribes a structure to a material point. This concept is useful for combining ideas concerning microscopic structure with thoughts concerning the macroscopic behavior of materials. The purpose of this paper is to describe some theories of this type which can be used to describe nonlinear mechanical behavior of solids. Author

N64-13434 Massachusetts Inst. of Tech., Cambridge
DEFECTS IN SOLIDS AT HIGH VELOCITY DEFORMATION
Allen N. Stroh *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 59–78 refs (See N64-13431 05-01)

The behavior of dislocations moving at both subsonic and supersonic velocities is reviewed. At supersonic velocities energy is radiated and a rather high stress is needed to maintain the motion. The properties of edge and screw dislocations which differ much more at high velocities than at low are contrasted. A major problem of dislocation dynamics is the nature of the resistive forces limiting the velocity, and current ideas on this are discussed. The dependence of the dislocation velocity on the applied stress has been measured for several materials, but the relationship is not yet fully understood. The production of point defects by rapidly moving dislocations is considered. Author

N64-13437 Massachusetts Inst. of Tech., Cambridge
WAVE PROPAGATION IN UNIAXIAL STRAIN
John H. Percy *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 123–146 refs (See N64-13431 05-01)

Interest in this topic centers on the constitutive equation or behavior of materials under the extreme conditions of high-impulse loading. Recent and current work in the field is treated generally, and one area, the elastic-plastic behavior of aluminum at comparatively low pressures, is considered in detail. Author

N64-13438 Pennsylvania U., Philadelphia
UNIAXIAL STRESS CONDITIONS
Gordon L. Filbey, Jr. *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 147–172 refs (See N64-13431 05-01)

The propagation of waves of plastic deformation is experimentally studied in rods undergoing free flight impact with diffraction-grating strain gages. Verification of the strain-rate-independent theory of Karman and Taylor has been demonstrated for several annealed fcc metals, using impact velocities up to 1100 in./sec, and at 3000 in./sec in experiments with annealed aluminum. Aspects of dynamic overstress, initial development of the plastic wave, final strain distribution in finite rods, and unloading phenomenon are discussed. Author

N64-13439 California U., Berkeley. Lawrence Radiation Lab.
DISLOCATION CONCEPTS OF STRAIN RATE EFFECTS
John E. Dorn and Frank E. Hauser *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 173–205 refs (See N64-13431 05-01)

Whereas von Karman and Taylor independently based their analyses for plastic wave propagation on the deformation concept which assumes the deformation stress is exclusively a function of the plastic strain, Malvern believed that a viscoelastic type of behavior is more realistic, assuming the flow stress is a function of the strain rate as well as the strain. With relatively few exceptions, current investigators of plastic wave propagation phenomena are rather sharply divided into two camps, those that insist on the von Karman–Taylor type of formulation and those that adhere to the Malvern approach. It is the thesis of this paper that both concepts are substantially correct under appropriate circumstances. This thesis is upheld not only in terms of new experimental evidence, but also in terms of deductions arrived at from elementary dislocation theory. Author

N64-13443 Texas U., Austin
FRACTURE PHENOMENA
H. J. Plass *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 289–292 (See N64-13431 05-01)

The behavior of materials under high intensity tensile loads where the intensity of the load is high enough to cause separation of parts of the material (a fracture in the material) is discussed. R.T.K.

N64-13444 Naval Research Lab., Washington, D.C.
FRACTURE BY PROGRESSIVE CRACK EXTENSION
George R. Irwin *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 293–323 refs (See N64-13431 05-01)

This paper discusses the conditions governing the development of unstable progressive crack extension at normal speeds of stress application. Progress in this field has resulted from separating the topics of fracture initiation and crack extension. The relevance of laboratory tests to service behavior may then be represented for fracture initiation by flaw statistical analysis and for crack extension by fracture mechanics analysis. The concepts now at hand for fracture strength and for the ductile–brittle fracture mode transition will substantially assist the establishment of sound relationships between atomic and macroscopic properties. Author

N64-13445 Minnesota U., Minneapolis
TIME DEPENDENT FRACTURE
C. C. Hsiao *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 325–355 refs (See N64-13431 05-01)
(Supported in Part by AEC)

A brief account is given of some recent efforts here and abroad in studying the nature of rupture of solids. One of the important factors has been found to be the variation of time in the process of destruction of the solids. For a large variety of solids, both in experiment and in theory, the logarithm of time has shown to be linearly related to the applied uniaxial state of tensile breaking stress. This linear law has been established, at least for some solids, over a time range of a dozen decades from microseconds through months. Author

N64-13446 Sandia Corp., Albuquerque, N. Mex.
SPALL FRACTURE
C. Donald Lundergan *In* Aeron. Systems Div. Proc. of Symp. on Struct. Dyn. under High Impulse Loading May 1963 p 357–382 refs (See N64-13431 05-01)

The reported spall thresholds in copper (the upper and lower fracture, and the separation) are discussed in relation to the stress-time history in the region of failure and to the experimental techniques used to induce the shock waves. Also considered are the dynamic properties under uniaxial strain, and the geometry of the medium which influences the fracture and separation spall thresholds in polycrystalline metals. Author

N64-13603 Republic Aviation Corp., Farmingdale, N.Y.
ENGINEERING PROGRESS REPORT ON INVESTIGATION OF THE BASIC MECHANISM OF METAL FATIGUE Quarterly Report No. 1, 1 Jun.–30 Sep. 1963
Barry Z. Hyatt and Louis J. Teutonico 28 Oct. 1963 22 p refs
(Contract NOw-63-0704-c)
(RAC-921-1; AD-425449)

The mechanism of metal fatigue is being investigated by studying dislocation dynamics in single crystals during stress cycling by means of ultrasonic attenuation measurements in the megacycle frequency range. The basic investigation will be limited to the first cycle of stress–essentially a study of the Bauschinger effect. A method for growing oriented copper single crystals is described, and techniques for electrochemical cutting and chemical polishing are discussed. Self-aligning tension-compression grips were designed and fabricated to facilitate study of the deformation of the copper single crystals. Author

N64-13618 Brown U., Providence, R.I. Engineering Div.
DISLOCATION MULTIPOLES AND THEIR ROLE IN STRAIN-HARDENING Technical Report No. 6
H. S. Chen, J. J. Gilman, and A. K. Head Oct. 1963 54 p refs
(Contract Nonr 562(32)/6)
(AD-426456)

The stress fields of edge-dislocation dipoles are able to trap other edge dislocations that approach them. The configurations, energies, and trapping stresses of the resulting tripoles are discussed here in some detail. Dipoles may also interact dynamically with approaching dislocations because they cause fluctuating stresses. The decrease in the average velocity of a moving dislocation is given in terms of the fluctuation amplitude and the dislocation's "mobility parameter". On the basis of these results, linear strain hardening can be accounted for in terms of edge-dislocation dipoles. Since dipoles in real crystals tend to be finite in length and their stress fields attenuate rapidly with distance, they act like particles to impede dislocation motions. Thus hardening is proportional to the dipole concentration which is proportional to the plastic strain, so the hardening will be linear in the strain. Author

N64-13619 Hughes Aircraft Co., Newport Beach, Calif. Semiconductor Div.
TRANSISTOR DESIGN EFFECTS ON RADIATION RESISTANCE Quarterly Report No. 1, 15 Jun.–15 Sep. 1963
[1963] 44 p refs
(Contract DA-36-039-AMC-02352(E))
(AD-425369)

This report covers the evaluation of materials suitable for transistor fabrication. Crystals were grown which contained the levels and types of dopants approximating the base and the collector materials. The crystals were cut into bars and irradiated with short high-intensity pulses from the Linac. Because of the low resistivity of the base materials, gamma (bremsstrahlung) radiation did not produce a measurable response. It was therefore decided to subject all test specimens to 5 μs bursts of direct electron radiation. The peak changes in conductivity caused by electron-hole generation are compared. As expected from theory, the response to radiation is largely a function of minority carrier lifetime. The gold-doped specimens had about one-tenth the response of those without gold doping. Author

N64-13625 Radio Corp., of America, Princeton, N.J.
INVESTIGATION OF CARRIER INJECTION ELECTROLUMINESCENCE Final Report, 15 Jan. 1961–14 Sep. 1963
A. G. Fischer David Sarnoff Res. Center, 15 Oct. 1963 33 p
(Contract AF 19(604)-8018)
(AFCRL-63-526; AD-426463)

To develop a solid-state light source, the mechanism of the existing electroluminescence of zinc sulfide powder was studied, and it was found to be based on bipolar alternating injection of electrons and holes from conducting, copper-decorated imperfection lines, and recombination at field reversal.

To extend this principle to efficient dc operation, the technology of crystal growth of luminescent, conducting II-VI compounds from the melt under pressure was developed, and preparation methods and properties of thin, evaporated, conducting, luminescent films were investigated. Efforts to prepare injecting junctions encountered difficulties because of the tendency of II-VI compounds to compensate acceptors with donor vacancies. Several less efficient injection mechanisms were found to be active in the resulting broad p-i-n heterojunctions. A new type of injecting heterojunction based on tunneling through thin insulating films was invented which permits minority carrier injection into luminescent semiconductors regardless of compensation. Author

N64-13636 Systems Research Labs., Inc., Dayton, Ohio
LOW ENERGY ELECTRON DIFFRACTION FROM SINGLE CRYSTAL SURFACES. I: APPARATUS DESIGN
E. L. Kern, D. E. Floyd, and P. W. Bunce Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Nov. 1963 61 p
(Contract AF 33(657)-10798)
(ARL 63-197; AD-426752)

A low-energy electron-diffraction apparatus has been designed, developed, and constructed, and will be used to study the surface condition and structure of single-crystal metals and semiconductors. The electron gun, adapted from a design by Farnsworth, uses a nickel matrix cathode, and is capable of producing electrons with energies of from 20 to several hundred electron volts with currents from 0.1 to 10 μamp. The electrons diffracted from a surface can be scanned over a majority of an octant (0 to 75 degree colatitude, 0 to 90+ degree azimuth) using the general approach of Farnsworth, and currents as low as 1×10^{-13} amp can be measured at the collector. An angle programer has been developed to precisely program the angles to be swept, and the angular motion is transferred through a glass chamber wall by a pair of magnetic couplers. The apparatus and some of its characteristics are described in this report. Author

N64-13659 HP Associates, Palo Alto, Calif.
INVESTIGATION OF HOT ELECTRON EMITTER Scientific Report No. 5, 1 Jun.-31 Aug. 1963
M. M. Atalla et al [1963] 24 p refs
(Contract AF 19(628)-1637)
(AFCRL-63-553; AD-425523)

A new type of cadmium-sulfide evaporation source in which the rate is diffusion limited is discussed. Typical thickness-versus-time and rate-versus-temperature dependences are presented, and the rate is found to be dependent only on source temperature. Spectrochemical analysis of the films indicates that the film dopant concentration is approximately 20% of the source concentration. This measurement is verified by electrical measurements on the films. A discussion of possible advantages of evaporating CdSe instead of CdS for a triode collector is presented. The capacity-voltage and current-voltage of a gold to cadmium selenide barrier are presented, and the internal barrier height is found to be 0.82 ev, which is compatible with a gallium arsenide emitter. Further data are presented for the reverse leakage mechanism of image force lowering of the barrier. Author

N64-13675 Philco Corp., Blue Bell, Pa. Philco Scientific Lab.
A FUNDAMENTAL STUDY OF EPITAXY BY FLASH EVAPORATION First Semiannual Scientific Report
John L. Richards 30 Sep. 1963 51 p refs
(Contract AF 19(628)-2937)
(AFCRL-63-524; AD-426134)

A study has been made of the conditions under which films of III-V compounds can be evaporated and deposited stoichiometrically onto a number of substrates. The crystalline nature and crystal quality of films of seven of the III-V compounds deposited onto Ge, CaF_2, GaAs substrates have been studied with reference to changes in such parameters as evaporator and substrate temperature, lattice mismatch with substrate, and substrate orientation. Conditions have been determined for the preparation of expitaxial films. Films of mixed semi-conductor systems can be deposited by the flash evaporation of mixed powders. This process offers a rapid method of studying solid solution formation in such mixed crystal systems. The systems Ge:GaP and GaAs:GaP have been studied in this manner and show complete solid solubility throughout the composition range. Using the method of flash evaporation of mixed powders, films of all of the quasi-binary systems possible were prepared, and the lattice constants and phase relationships within these films were determined using X-ray, electron diffraction, and optical absorption techniques. Author

N64-13720 American Science and Engineering, Inc., Cambridge, Mass.
INVESTIGATION OF GROWTH OF OPTICAL CRYSTALS SUITABLE FOR LASER OPERATION Final Report [15 Jul.-30 Sep. 1963]
30 Oct. 1963 21 p refs
(Contract AF 19(628)-2470)
(ASE-466; AFCRL-63-518; AD-426488)

Among the tasks included in the investigation were: (1) the surveillance of optical crystals to determine those most suitable for laser operation; (2) the acquisition of background information necessary for the growth of selected crystals; and (3) the preparation of single crystals. Crystal-growth studies were confined to Verneuil furnace work, Czochralski furnace work, and growth from a flux. Results of studies on the growth of beryl and scapolite single crystals by flux crystallization are reported. R.T.K.

N64-13730 Joint Publications Research Service, Washington, D.C.
OBTAINING MOLYBDENUM SINGLE CRYSTALS AND THEIR PROPERTIES
V. S. Yemel'yanov, A. I. Yevstyukhin, G. A. Leont'yev, and A. N. Semenikhin *In its* Soviet Res. in Production and Phys. Met. of Pure metals 10 Jan. 1964 p 39-45 refs (See N64-13726 05-01) OTS: $3.00

A method of growing molybdenum single crystals from the gaseous phase by thermal dissociation of $MoCl_5$ is described. Filaments up to 3-mm thick consisting of monocrystal segments up to 90-mm long were obtained. These crystals bent easily at room temperature, had a microhardness in the range 180 to 200 kg/mm^2 (200 gm load), a modulus of elasticity somewhat greater than ordinary molybdenum, and an internal friction which increased monotonically from 1.6×10^{-5} at −190° C to 3.8×10^{-5} a 200° C. The effects of quenching and annealing of the single crystals on the internal friction were also investigated. M.P.G.

N64-13744 Aerospace Corp., El Segundo, Calif.
ELECTRONICS RESEARCH PROGRAM—OPTICAL MASER STUDIES Semiannual Technical Report [Final] 1 Jan.-30 Jun. 1963
M. Birnbaum and T. L. Stocker 25 Nov. 1963 32 p refs
(Contract AF 04(695)169)
(TDR-169(3250-22)TR-2; SSD-TDR-63-300; AD-426013)

CONTENTS:

1. EFFECT OF DIFFRACTION ON THE OUTPUT BEAM OF A RUBY LASER M. Birnbaum and T. L. Stocker p 1–11 refs (See N64-13755 05-25)

2. MULTIMODE OSCILLATION OF THE RUBY LASER NEAR THRESHOLD M. Birnbaum and T. L. Stocker p 12–22 refs (See N64-13756 05-25)

N64-13745 Aerospace Corp., El Segundo, Calif.
EFFECT OF DIFFRACTION ON THE OUTPUT BEAM OF A RUBY LASER
M. Birnbaum and T. L. Stocker *In its* Electron. Res. Program–Opt. Maser Studies 25 Nov. 1963 p 1–11 refs Submitted for Publication (See N64-13744 05-25)

Observations were made of the near-field and far-field patterns of a ruby laser operated near threshold. In these observations, the beam diffraction effect predicted for diffraction by a small, elliptically shaped aperture was observed. This effect was a 90-degree rotation of the elliptical figure. The beam divergence was greater than that predicted using diffraction theory. R.T.K.

N64-13746 Aerospace Corp., El Segundo, Calif.
MULTIMODE OSCILLATION OF THE RUBY LASER NEAR THRESHOLD
M. Birnbaum and T. L. Stocker *In its* Electron. Res. Program—Opt. Maser Studies 25 Nov. 1963 p 12–22 refs Submitted for Publication (See N64-13744 05-25)

Experimental results were obtained demonstrating that many axial modes are present in the output of a ruby laser which is operated very close to threshold. Multimode operation was found to be the rule, even when the output of the laser appeared as a regularly spaced, exponentially damped series of spikes. Theoretical analysis of the laser oscillations indicates that the initial laser spike transient should damp out, leaving only the cw (continuous wave) oscillation of the laser. This effect was observed in a ruby laser operated close to threshold. In many cases, the initial train of laser pulses appeared to damp out and approach a cw level of oscillation. A cw beat frequency was often found to coincide with the cw light output. R.T.K.

N64-13747 General Electric Co., Schenectady, N.Y.
SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 5A
H. H. Woodbury et al 31 Oct. 1963 73 p refs
(Contract AF 19(628)-329)
(AFCRL-63-552(A); AD-426258)

CONTENTS:

1. THE DIFFUSION OF Cd IN CdS H. H. Woodbury p 2–31 refs (See N64-13748 05-25)

2. LUMINESCENCE INTENSITY-CURRENT-TEMPERATURE RELATIONSHIPS FOR Cu_2 Se-ZnSe HETEROJUNCTION DIODES M. Aven p 32–46 refs (See N64-13749 05-25)

3. SILICON CARBIDE DIODE "LASER" R. N. Hall p 47–58 refs (See N64-13750 05-25)

4. $GaAS_{1-d}P_d$ SYNTHESIS R. N. Hall and T. J. Soltys p59–61 refs (See N64-13751 05-25)

5. LIGHT EMISSION FROM GaSb AND $Ga_dIN_{1-d}Sb$ JUNCTION DIODES J. H. Racette p 62–69 refs (See N64-13752 05-25)

N64-13748 General Electric Co., Schenectady, N.Y.
THE DIFFUSION OF Cd IN CdS
H. H. Woodbury *In its* Semicond. Device Concepts 31 Oct. 1963 p 2–31 refs (See N64-13747 05-25)

The self-diffusion of Cd in CdS has been measured under a variety of doping and firing conditions. Under saturated Cd pressure the diffusion coefficient is given by $D = 3 \exp(-2.0 \text{ ev}/kt)$. Under S pressure at 800° C, the diffusion coefficient is found to be linearly dependent on the donor impurity concentration. A new mechanism for diffusion is proposed to explain the results. No evidence for interstitial Cd was observed, and it is suggested that Cd and sulfur vacancies (Schottky defects) are the dominant native defects in CdS. Author

N64-13749 General Electric Co., Schenectady, N.Y.
LUMINESCENCE INTENSITY-CURRENT-TEMPERATURE RELATIONSHIPS FOR Cu_2Se-ZnSe HETEROJUNCTION DIODES
M. Aven *In its* Semicond. Device Concepts 31 Oct. 1963 p 32–46 refs (See N64-13747 05-25)

By measuring the position of the peak of the edge-emission exciton band it has been possible to monitor accurately the temperature of operating Cu_2Se-ZnSe injection electroluminescent heterojunctions. With the aid of this method, the relationships between the intensity of electroluminescent emission and the current and between the luminescence intensity and temperature have been determined for the edge emission, the A_2 center emission, and the self-activated center emission. Author

N64-13750 General Electric Co., Schenectady, N.Y.
SILICON CARBIDE DIODE "LASER"
R. N. Hall *In its* Semicond. Device Concepts 31 Oct. 1963 p 47–58 refs (See N64-13747 05-25)

Luminescence from traveling solvent SiC diodes is discussed. It is concluded that the narrow emission line which has been reported is due to the spontaneous recombination of bound excitons and is unrelated to coherent light emission. Author

N64-13751 General Electric Co., Schenectady, N.Y.
$GaAs_{1-x}P_x$ SYNTHESIS
R. N. Hall and T. J. Soltys *In its* Semicond. Device Concepts 31 Oct. 1963 p 59–61 refs (See N64-13747 05-25)

Growth of crystals from a gallium solution was studied as a method of preparing mixed crystals of gallium arsenate and gallium phosphate which are used to construct diodes. Runs were made to obtain these crystals; the procedure used is discussed; and the two compositions used for the runs are given. Diodes were made from the crystals obtained from the runs. The wavelengths of the radiation produced by the diodes indicate that the compositions of the crystals are reasonably close to the design value. C.L.W.

N64-13752 General Electric Co., Schenectady, N.Y.
LIGHT EMISSION FROM GaSb AND $Ga_xIn_{1-x}Sb$ JUNCTION DIODES
J. H. Racette *In its* Semicond. Device Concepts 31 Oct. 1963 p 62-69 refs (See N64-13747 05-25)

The growth of mixed crystals of gallium, indium, and antimony was studied in order to eliminate the influence of an indirect minimum in gallium antimonide diffused junction diodes. A Czochralski technique was used to grow the crystals. A crystal was grown from a melt containing 10% indium antimonide and 90% gallium antimonide. This crystal was studied using a Debye-Scherrer X-ray technique, and was found to be single phase with a lattice constant which indicates a composition of 2% indium antimonide. Diodes were constructed from this material and were pulsed at 77° K, and the integrated radiated output was measured as a function of

current. Results were similar to those obtained using gallium antimonide diodes, the output varying with the diodes' current. C.L.W.

N64-13777 Aerospace Corp., El Segundo, Calif. Labs. Div.
VIBRONIC SPECTRA OF SrF_2Sm^{2+} AND BaF_2:Sm+· [Semi-annual Report, 1 Jan.-30 Jun. 1963]
Isaac Richman 22 Nov. 1963 17 p refs
(Contract AF 04(695)-169)
(TDR-169(3250-24)TN-3; SSD-TDR-63-297; AD-427088)

Recent work has yielded vibronic data on Sm^{2+} doped in two isomorphic crystals, SrF_2 and BaF_2. A model using Born–von Karman boundary conditions, which predicts the number of vibronic satellites and the k = 0 selection rules, is proposed in this report. It is shown, however, that the k = 0 selection rules are too restrictive to explain the vibronic spectrum and that to obtain a satisfactory explanation, transitions involving vibrations away from k = 0 must be considered. The model, when such transitions are taken into account, is shown to be consistent with the observed data. It is proposed that one of the modes observed in the vibronic spectrum corresponds to vibrations of the transverse optical branch, a second to the longitudinal optical branch, and a third to transitions away from k = 0 involving the Raman active branch. This model is able to qualitatively explain the differences observed in the two host lattices. Raman scattering data have been obtained placing the F_{2g} mode (at k = 0) at 280 cm^{-1} in SrF_2 and at 243 cm^{-1} in BaF_2. Author

N64-13778 Aerospace Corp., El Segundo, Calif. Labs. Div.
ELECTRONIC ENERGY LEVELS OF $Er^{3+}(4f^{11})$ IN LaF_3 [Semiannual Report, 1 Jan.-30 Jun. 1963]
W. F. Krupke 8 Nov. 1963 39 p refs
(Contract AF 04(695)-169)
(TDR-169(3250-24)TN-4; SSD-TDR-63-298; AD-427079)

The analysis of the electronic states (optical spectrum) of trivalent erbium in single crystals of LaF_3 has been extended, based on new absorption measurements to 5000 cm^{-1} in the infrared and to 50,000 cm^{-1} in the ultraviolet, and on fluorescence measurements from 3000 A to 25,000 A. The crystal field Stark components and energy centers of gravity of 21 J-levels have now been established. The parameters giving the best overall agreement between the predicted "free-ion" spectrum and 21 of the observed energy centers of gravity are F_2 = 435.74 cm^{-1}, F_4 = 67.208 cm^{-1}, F_6 = 7.388 cm^{-1}, and ζ = −2350.82 cm^{-1}. An intense ultraviolet absorption between 3500 A and 1850 A, observed in even "pure" crystals of LaF_3, is discussed in terms of impurities and lattice defects. Coherent emission at 1.6μ has been observed at 77° K; experiments to observe green coherent emission are also briefly discussed. Author

N64-13784 Tyco Labs., Inc., Waltham, Mass.
STUDY OF SURFACE STATES IN SEMICONDUCTORS
G. Rupprecht Griffiss AFB, N.Y., RADC, Dec. 1963 21 p
(Contract AF 30(602)-3157)
(RADC-TDR-63-464; AD-427117)

Apparatus for the pulsed-field effect was assembled and tested by reproducing previous experiments on silicon and germanium surfaces. Measurements on n-type silicon indicate surface states with cross sections of 10^{-12} cm^2 0.73 ev below the conduction band, near those previously reported at 0.62 ev. The pulsed-field effect experiment on germanium surfaces, however, revealed slow surface states, with decay times increasing as adsorbed gases were removed. Author

N64-13785 General Electric Co., Syracuse, N.Y.
FAILURE MECHANISMS AT SURFACE AND INTERFACES First Interim Technical Documentary Report, 1 Jul.-1 Oct. 1963
K. K. Beinhartz, V. A. Russell, D. L. Stockman, W. J. van der Grinten, and W. L. Willis Griffiss AFB, N.Y., RADC, Dec. 1963 51 p refs
(Contract AF 30(602)-3085)
(RADC-TDR-63-474; AD-427058)

One hundred and fifty plates, each containing three thin-film active devices, were fabricated, and approximately 50 of them were subjected to temperature, humidity, and electrical stresses under controlled conditions. The initial objective, which was to establish stress levels leading to significant changes of device parameters within one or two weeks, was achieved in all cases. For thin-film triodes, the parameter found to be most sensitive to "aging" effects was the d.c. gate voltage necessary to obtain a standard power output. An analytical expression for a high-temperature degradation case has been found indicating that the corresponding failure mechanism occurs at the SiO-CdS interface. High-humidity stresses produced gradual degradation and partially reversible catastrophic failures. Author

N64-13789 Raytheon Co., Burlington, Mass. Spencer Labs.
PHOTOELECTRIC MILLIMETER WAVE DETECTOR
P. R. Bratt and G. F. Giggey Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 47 p refs
(Contract AF 30(602)-3015; AF 33(616)-7983; AF 30(602)-2637)
(RADC-TDR-63-502; AD-427092)

The method of approach involves the use of the internal photoelectric effect (i.e., photoconductivity) in certain semiconductor materials at very low temperatures. The program can be broken down into four main phases: (1) investigation of indium antimonide in a magnetic field; (2) investigation of gallium arsenide and/or indium arsenide in a magnetic field; (3) investigation of germanium and its behavior under stress; and (4) fabrication of experimental and breadboard model detectors. Investigations on indium antimonide in a magnetic field are continuing. Samples of gallium arsenide have been acquired, and measurements on this material are beginning. A theoretical analysis has been performed to establish the limits of sensitivity of the various types of long wavelength photoconductive detectors which have been developed, and the performance of actual detectors is compared with the theoretical limit. Author

N64-13796 Cornell U., Ithaca, N.Y.
INVESTIGATION OF NEW CONCEPTS FOR MICROWAVE POWER GENERATION. LASER STUDIES Final Report
G. C. Dalman Griffiss AFB, N.Y., Rome Air Develop. Center, Dec. 1963 113 p refs
(Contract AF 30(602)-2833)
(RADC-TDR-63-465, Vol. 2; AD-427115)

CONTENTS:

1. PRELIMINARY STUDIES OF ELECTRON EMISSION FROM TUNGSTEN INDIRECTLY HEATED BY A PULSED LASER G. C. Dalman 10 p refs (See N64-13797 05-25)
2. NOTE ON ELECTRON AND ION EMISSION FROM LASER-HEATED OXIDE CATHODES G. C. Dalman 7 p (See N64-13798 05-25)
3. DOUBLE-QUANTUM PHOTOELECTRIC EMISSION G. Wolga and H. Bowers 8 p refs (See N64-13799 05-25)
4. AN INVESTIGATION OF ELECTRON EMISSION FROM A TUNGSTEN SURFACE INDUCED BY A LASER BEAM L. A. Mac Kenzie 81 p refs (See N64-13800 05-25)

N64-13797 Cornell U., Ithaca, N.Y.
PRELIMINARY STUDIES OF ELECTRON EMISSION FROM TUNGSTEN INDIRECTLY HEATED BY A PULSED LASER
G. C. Dalman *In its* Invest. of New Concepts for Microwave Power Generation. Laser Studies Dec. 1963 10 p refs (See N64-13796 05-25)

An experimental and theoretical investigation of the emission of electrons, ions, and vertical particles from a tungsten cathode which is "surface-heated" by a laser beam is described. Principal emphasis is given the phenomenon of electron emission because of the interest in its application to the formation of a very dense electron beam. Two different experimental approaches are taken in obtaining electron emission. The first approach is to collect electrons which are "boiled off" the surface the laser beam strikes, whereas the second approach is to use a very thin tugsten ribbon to collect electrons from the surface opposite the one the laser beam strikes. Preliminary theoretical work describing these phenomena is discussed. Author

N64-13798 Cornell U., Ithaca, N.Y.
NOTE ON ELECTRON AND ION EMISSION FROM LASER-HEATED OXIDE CATHODES
G. C. Dalman *In its* Invest. of New Concepts for Microwave Power Gneration. Laser Studies Dec. 1963 17 p (See N64-13796 05-25)

An exploratory study of the emission of electrons and ions from a cold barium oxide cathode surface was made to assess the usefulness of the conventional oxide cathode as a high-density current source. It is indicated that a laser-radiated oxide-coated cathode does not seem practical, since the coating readily breaks down. However, advantage may be taken of this effect to produce a pulsed source of high-density positive or negative ions. I.v.L.

N64-13799 Cornell U., Ithaca, N.Y.
DOUBLE-QUANTUM PHOTOELECTRIC EMISSION
G. Wolga and H. Bowers *In its* Invest. of New Concepts for Microwave Power Generation Laser Studies Dec. 1963 8 p refs (See N64-13796 05-25)

A theoretical study of double photon-induced photoelectric emission from single zinc crystals was made, and an experiment was designed to observe such emission. The double-photon absorption process leading to this photoelectric emission is a second-order process in the conventional perturbation treatment of the interaction of free, metallic electrons with electromagnetic radiation; therefore, a ruby laser was used as a source of light in order to obtain the high fields necessary to produce this emission in measurable quantities. A detailed study of thermionic emission was made to distinguish the second-order photoelectric emission from simultaneously occurring thermionic emission. It was revealed that a high-frequency modulation of the laser light impinging on the crystal might well make the second-order effect observable. The quantum mechanical effects of this modulation on the second-order photoeffect were studied in detail along with the thermionic emission response to this modulation. The modulation is accomplished by means of the longitudinal Pockel's effect in KDP. I.v.L.

N64-13800 Cornell U., Ithaca, N.Y.
AN INVESTIGATION OF ELECTRON EMISSION FROM A TUNGSTEN SURFACE INDUCED BY A LASER BEAM
L. A. Mac Kenzie *In its* Invest. of New Concepts for Microwave Power Generation. Laser Studies Dec. 1963 81 p refs (See N64-13796 05-55)

The emission of electrons and ions from a metallic cathode when the surface is heated by a pulsed laser beam was investigated experimentally. The incident energy of the laser beam on the cathode ranged from 0.1 joules to 3 joules over a 300-μsec pulse. A very large electron emission density was found under ordinary thermionic emission conditions. Also, a plasma discharge was obtained, which contained a large volumetric electron density. Some initial theoretical work is described as support for the experiments reported. Author

N64-13801 ITT Federal Labs., Nutley, N. J. Physical Sciences Lab.
RESEARCH AND DEVELOPMENT FOR SINGLE CRYSTAL GROWTH BY ELECTROCHEMICAL TECHNIQUES Final Technical Engineering Report, Jun. 1961-Sep. 1963
P. E. Lighty, D. J. Shanefield and S. I. Burghardt Nov. 1963 43 p refs
(Contract AF 19(604)-8490)
(AFCRL-63-542; AD-427306)

Single crystals of copper were grown at room temperature by slow, high-purity electrodeposition. With special purification of the solutions, the crystals had flat surface areas free of growth hillocks, and a connection between impurities and hillock formation was established. Under these conditions, crystals had higher degrees of lattice perfection than did the seeds. An explanation is proposed. There is evidence that screw dislocations are continued into the growth, but edge dislocations are not. Attempts to electrodeposit germanium and silicon in pure single-crystal form were unsuccessful. However, these two elements were electrodeposited from aqueous solutions in polycrystalline form. The deposition of hydrogen was a competing reaction which limited the thickness of the solid deposit. The theory of Lewis acid–base interactions was used to make conductive solutions in nonprotonic solvents. With this method, gallium arsenide was electrodeposited in polycrystalline form at room temperature. Hydrogen was not codeposited. Author

N64-13815 Naval Ordnance Lab., White Oak, Md.
THEORETICAL EQUATION OF STATE FOR FACE CENTERED CUBIC METALS
D. J. Pastine 7 Aug. 1963 32 p refs
(NOLTR-63-108; AD-427081)

A Morse function is used as the form of the volume dependent energy term in the expression for the Helmholtz free energy of a Debye solid. The consequent form of the Mie–Gruneisen equation of state is then obtained using an adjusted form of the Slater relation for the Gruneisen parameter. Theoretical Hugoniots are then calculated for Al, Cu, and Ag and are found to agree well with experimental Hugoniots over a broad pressure range. Author

N64-13841 Republic Aviation Corp., Farmingdale, N.Y.
A STUDY OF FRACTURE PHENOMENA Final Report, 15 Jun. 1960-22 Jul. 1963
L. Teutonico Kirtland AFB, N. Med., Res. and Technol. Div. Dec. 1963 72 p refs
(Contract AF 29(601)-2869)
(RAC-1699; RTD-TDR-63-3081; AD-426664)

An analysis is made of uniformly moving dislocations in anisotropic media. The analysis has been developed not only for diad axes (for which the edge and screw components of a dislocation can be treated separately) but also for the case of arbitrary orientation (for which both a pure screw and a pure edge involve three components of displacement). Use is made of the analysis to study the dynamical behavior of dislocations in the primary slip systems of both fcc and bcc crystals. Edge

dislocations lying along various diad axes in a number of cubic and hexagonal materials are also considered. Of primary interest are the calculation of the force between two like parallel dislocations and the determination of whether or not there exists a velocity range in which this force, which usually repels, can attract. In those cases for which the force can attract, the width of the velocity range of anomalous dynamical behavior is computed for various materials. Author

N64-13843 Aerospace Corp., El Segundo, Calif. Labs. Div.
ELECTRONICS RESEARCH PROGRAM. INFRARED AND ULTRAVIOLET DEVICE RESEARCH Semiannual Technical Note, 1 Jan.-30 Jun. 1963
J. Munushian 31 Oct. 1963 39 p refs
(Contract AF 04(695)-169)
(TDR-169(3250-11)TN-2; SSD-TDR-63-299; AD-426153)

Coherent operation of a gallium arsenide injection laser has been achieved, and spectral characteristics, efficiency, and power capability have been studied in a large number of units. A phenomenological theory, based on a study of the spectral response of recombination radiation, has been developed which indicates that the radiation originates from a transition between the conduction band and a distinct zinc acceptor level. Various technological problems encountered in fabricating successful injection lasers have been explored in detail. The problem of zinc diffusion and uneven junctions has been alleviated by the use of a zinc–gallium diffusion source which permits good control over the zinc vapor pressure. Study of thermal decomposition of gallium arsenide, which can degrade the p-n junction in an injection laser, has resulted in a comprehensive picture of the nucleation and development of thermal decomposition in terms of the crystallographic parameters of the material. Author

N64-13844 General Electric Co., Syracuse, N.Y. Advanced Semiconductor Lab.
SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 5B
N. Holonyak, Jr. et al 31 Oct. 1963 25 p refs
(Contract AF 19(628)-329)
(AFCRL-63-552(B); AD-426254)

Halogen vapor transport synthesis of $Ga(As_{1-x}P_x)$ and its preparation into laser junctions are described. Electrical and optical properties of $Ga(As_{1-x}P_x)$ laser junctions are discussed. The present limitations in these properties are related to material problems and the very early state of development of $Ga(As_{1-x}P_x)$, and are discussed in this context. Inhomogeneity problems, fluctuation of As:P ratio, and problems with deep-level contaminants are described and related to $Ga(As_{1-x}P_x)$ junction performance. Laser junctions are demonstrated which operate to wavelengths as short as 6470A (77° K). The prospect that $Ga(As_{1-x}P_x)$ will operate to wavelengths perhaps 100A shorter is mentioned. Author

N64-13912* Massachusetts Inst. of Tech., Cambridge
FREQUENCY STABILITY OF He-Ne Masers AND MEASUREMENTS OF LENGTH
T. S. Jaseja, A. Javan, and C. H. Townes Repr. from Phys. Rev. Ltr., v. 10, no 5, 1 Mar. 1963 p 165-167 refs
(NASA Grant NsG-330)

Frequency stability of the oscillation of He-Ne masers at 1.153 was examined under controlled conditions. Frequency spread of the oscillation (stability over very short times) was reduced to about 20 cps, or about eight parts in 10^{14}; frequency drifts as slow as a few tens of cycles per second were obtained; and the frequency resettability for a given maser over long periods of time was found to be somewhat less than 0.5 megacycle, or about one part in 10^9. Short-term stability is within about one order of magnitude of the theoretical limit expected for these particular masers, and each of the results are measures of the masers' ability to determine lengths with great precision. R.T.K.

N64-13913* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SINGLE-CRYSTAL GERMANIUM FILMS BY MICRO-ZONE MELTING
J. Maserjian Repr. from Solid-State Electron. (London), v. 6, Sep.-Oct. 1963 p 477-484 refs
(NASA Contract NAS7-100)
(NASA CR-55315; JPL-TR-32-418)

A technique has been developed for growing single-crystal germanium films in situ on a dielectric substrate. An electron beam is used to melt a small zone of a polycrystalline germanium film. Single-crystal growth is induced by electrically scanning the beam in a preferred manner over a selected region of the film. An additional heat source maintains the surrounding film at elevated temperatures in order to avoid excessive temperature differentials. The scanning pattern employed permits a randomly nucleated crystallite to seed the surrounding growth. In this manner, a single crystal, the order of a millimeter across, can be grown in a chosen location. Larger crystals should be possible with larger beam deflections. This work has been largely confined to film thicknesses of 3μ to 10μ and to substrates of sapphire. Sapphire was used because its coefficient of thermal expansion closely matches that of germanium and because of other desirable properties. All films were deposited by vacuum evaporation. The technique is logically extendable to other materials that can be grown in vacuum. Author

N64-13929* Massachusetts Inst. of Tech., Cambridge
GASEOUS OPTICAL MASERS AND THEIR APPLICATIONS
A. Javan [1963] 35 p refs Presented at the Materials Sci. Colloq., Ithaca, N.Y., 5 Nov. 1963 Submitted for Publication
(NASA Grant NsG-330)
(NASA CR-55276) OTS: $3.60 ph, $1.25 mf

A He-Ne system is described that is capable of producing oscillations at a large number of wavelengths. Its range covers a number of transitions in the red-yellow region of the spectrum as well as numerous transitions in the infrared region. The Ne atoms are responsible for the atomic transitions leading to maser oscillations. The He atoms provide a highly efficient source of excitation of the maser levels of Ne. Another gaseous discharge system is described in which dissociation of an oxygen molecule, O_2, is used for the purpose of producing an oxygen atom in a given excited electronic state. An optical frequency oscillator is considered which consists of a gaseous discharge tube placed within an optical resonator. The resonator consists of two plane parallel (or two spherical) mirrors which are held rigidly by means of an external mechanical support. Such a configuration forms a Fabry-Perot interferometer. The following properties of optical masers are also discussed: the ability to detect small changes of length, frequency characteristics, frequency reproducibility, and length standard. R.T.K.

N64-13959 Technical Research Group, Inc., Melville, N.Y.
RESEARCH ON PROPERTIES OF LASER DEVICES Sixth Quarterly Technical Summary Report, 1 Sep.-30 Nov. 1963
S. Rothberg and R. Kaplan, eds. [1963] 63 p refs
(Contract AF 49(638)-673; ARPA Order 256-62; Proj. Defender)
(TRG-134-QTR-6; AD-427259)

CONTENTS:

ANALYTICAL WORK
1. THEORY OF SPATIAL FLUCTUATIONS IN THE FIELD REFLECTED FROM DIFFUSE REFLECTOR p 2-1 to 2-5 refs
2. MODE STABILITY p 2-5 to 2-8 refs
3. EFFECT OF INDEX OF REFRACTION OF LASER ON REQUIRED BRIGHTNESS OF LASER LAMP p 2-9
4. FLUCTUATIONS AND SPECTRAL WIDTH OF LASER OSCILLATOR RADIATION FROM FUNDAMENTAL POINT OF VIEW p 2-9 to 2-10 refs

GAS LASER MEDIA
5. COLLISION LASER p 3-1 to 3-6 refs
6. BROADBAND OPTICAL PUMPING OF GASES: PHOTODISSOCIATION OF MOLECULES [AND] VAPORIZATION OF CHROMIUM TRIS-ACETYLACETONE p 3-6 to 3-10 refs

SOLID STATE MEDIA
7. NUCLEAR PUMPING p 4-1
8. CRYSTAL GROWTH p 4-1 to 4-6 refs

OUTPUT CONTROL
9. MODE SELECTOR EXPERIMENTS p 5-1 to 5-3
10. AMPLIFIER EXPERIMENT p 5-3 to 5-4
11. FLASH LAMP INVESTIGATION p 5-4 to 5-20 refs

APPENDIX
12. COHERENT DETECTION OF LIGHT SCATTERED FROM A DIFFUSELY REFLECTING SURFACE p A1 to A8 refs

N64-13961 Midwest Research Inst., Kansas City, Mo.
THE STRUCTURE AND STRENGTH OF EPITAXIAL FILMS Bimonthly Progress Report No. 1, 17 Oct.-17 Dec. 1963
Melvin Lavik et al 15 Jan. 1964 22 p refs
(Contract NOw-64-0061-d)
(AD-427339)

Literature concerning thin films has been reviewed and categorized with a coding system. A summary of the literature is included along with a brief outline of work to be accomplished during the second report period. The coded bibliography contains approximately one hundred references. Author

N64-13969 Lear Siegler, Inc., Santa Monica, Calif. Research Labs.
ACTIVE THIN FILM PROGRAM Final Development Report, 22 Jun. 1962-22 Aug. 1963
Milo Macha [1963] 42 p
(Contract NObsr-87634)
(AD-427338)

The purpose of this work was to develop techniques for vacuum evaporating single-crystal semiconductor films of germanium and/or silicon on insulating substrates. Basic feasibility studies of the films for use as active circuit elements in microelectronic assemblies, techniques for controlled doping, and fabrication of prototype elements and assemblies to prove feasibility of the processes and compatibility with vacuum-deposited passive elements were included. Author

N64-13987 Emmanuel Coll., Boston, Mass. Research Language Center
SYNTHETIC PRECIOUS STONES AND THEIR MANUFACTURE [LES PIERRES PRECIEUSES SCIENTIFIQUES ET LEUR FABRICATION]
F. Ravier Bedford, Mass., AFCRL, May 1963 26 p Transl. into ENGLISH from Chim. Ind. (Paris), v. 31, no. 5, 1934 p 1031-1039
(Contract AF 19(604)-8505)
(E-T-F-63-5; AD-412962)

Synthetic precious stones have a base of pure, crystallized alumina, obtained by fusing ammonia-alum. This article describes the means of obtaining this raw material, the use of different pigments, and the cutting of the gems. Author

N64-13989 Alfred U., N.Y. Coll. of Ceramics
EXPONENTIAL TEMPERATURE DEPENDENCE OF THE ELASTIC MODULI OF SINGLE-CRYSTAL AND POLYCRYSTALLINE MAGNESIUM OXIDE
Dae-Hyun Chung and W. G. Lawrence 30 Sep. 1963 45 p refs
(Contract DA-31-124-ARO(D-23))
(AROD-2891: 10; AD-426861)

The adiabatic technical elastic moduli $E_{[hkl]}$ and $G_{[hkl]}$ of single-crystals of magnesium oxide have been measured over a temperature range of 298° to about 1600° K by a Förster-type resonance method. These data were compared with the low temperature values (80° to 560° K) of the principal elastic constants c_{ij} and coefficients s_{ij} reported by Durand. Combining Durand's data and the present data, the elastic moduli for single-crystal magnesium oxide were evaluated for the temperature range of 80° to 1600° K. The isotropic Young's modulus and shear modulus of dense-formed polycrystalline magnesias were measured over the temperature range of 298° to 1600° K. The data on the single-crystals and polycrystalline magnesias as a function of temperature were compared on the basis of the Voight-Reuss-Hill approximation. The temperature dependence of the elastic moduli was fitted into the expression $M = M_o - B\,T \exp(-T_c/T)$, with mean deviations less than 0.2% for the temperature range considered. Author

N64-14022 Lincoln Lab., Mass. Inst. of Tech., Lexington
CHEMICAL BEHAVIOR OF SEMICONDUCTORS: ETCHING CHARACTERISTICS
H. C. Gatos and M. C. Lavine 2 Jan. 1963 60 p refs
(Contract AF 19(628)-500; ARPA-SD-90)
(Tech. Rept. 293; AD-401398)

The chemical properties of a semiconductor surface which pertain to chemical etching are generally a function of orientation, crystal structure, impurity concentration, and other parameters. The more pertinent of these parameters are discussed in some detail. Typical experimental findings are included. Author

N64-14069 California U., Berkeley. Lawrence Radiation Lab.
DIFFUSION OF IRON INTO SINGLE-CRYSTAL MgO
Stuart L. Blank (M.S. Thesis) 15 Nov. 1963 33 p refs
(Contract W-7405-eng-48)
(UCRL-11073) OTS: $0.75

MgO single crystals were packed in iron powder and heated in a vacuum at 1150°, 1250°, and 1350° C. Concentration-vs-penetration profiles were determined by using the electron microprobe analyzer. The interdiffusion coefficient D is found to be concentration dependent in the range 1 to 22 at. % Fe. The apparent activation energy for diffusion increases with the iron concentration. Author

N64-14105 Consiglio Nazionale delle Ricerche, Rome (Italy) Ist. Nazionale di Ultracustica
RELAXATION EFFECT DUE TO DISLOCATIONS IN NIOBIUM AND TANTALUM Final Technical Report No. 2, 1 Dec. 1961-31 Aug. 1963
Piero Giorgio Bordoni 1 Sep. 1963 106 p refs
(Contract DA-91-591-EUC-2051)
(AD-424622)

The relaxation effect due to dislocations in niobium and tantalum was investigated. Results indicate: (1) The relaxation effect is due to the motion of the dislocations near their equilibrium positions, as in fcc metals.(2) A more complete theory of this effect can be given taking into account the results concerning the subsidiary peak and the temperature shift of the main peak after thermal treatment. It is found that dislocation segments must have preferred orientations and that the dislocations, which are not cancelled by a thermal treatment, interact with point imperfections and reduce their activation energy and the limiting value of the relaxation time. I.v.L.

N64-14112 Michigan U., Ann Arbor Ins . of Science and Tech.
DYNAMIC BEHAVIOR OF QUANTUM MECHANICAL OSCILLATORS
George Makhov and Ojars Risgin Dec. 1963 17 p refs
(Contract DA-36-039-SC-78801; Proj. Michigan)
(Rept. 2900-383-T; AD-427186)

The time variation of amplitude of a maser oscillator is derived from a study of the rate equations connecting the population inversion and the electromagnetic energy stored in the maser resonator. The methods of nonlinear mechanics are used to derive a qualitative description of the amplitude variation in the absence of a complete solution of the rate equations. Modifications of the simple rate equations necessary to account for the existence of undamped relaxation oscillations are introduced for both microwave and optical masers, and their physical significance is discussed. The production of "giant pulses" of radiation is also treated. Author

N64-14138 Clevite Corp., Palo Alto, Calif. Shockley Lab.
STRUCTURAL IMPERFECTIONS IN SILICON P-N JUNCTIONS Final Report [15 Jul. 1962-15 Sep. 1963]
A. Goetzberger, R. H. Finch et al Oct. 1963 122 p refs
(Contract AF 19(604)-8060)
(AFCRL-63-538; AD-426916)

It was found that the application of an isotropic stress to a pn junction reversibly lowers the breakdown voltage. This effect was more easily detected because of the use of uniform avalanche junctions. Microplasma breakdown at stacking faults in epitaxially grown silicon is discussed. It was shown for the first time that stacking faults, a very frequent imperfection in epitaxial silicon, have a deleterious effect on device properties. Proof is furnished that there is no basic difference between microplasma breakdown and uniform avalanche breakdown. Previously such a difference had been assumed. Avalanche light emission in uniform junctions can be extinguished or enhanced by mechanical damage. It is concluded that donor levels are introduced into the space charge layer by plastic deformation. Author

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see:* 07 Chemistry; and 27 Propulsion.

N64-13410* Israel Program for Scientific Translations, Ltd., Jerusalem
COMBUSTION IN TURBULENT FLOW (GORENIE V TURBULENTNOM POTOKE)
L. N. Khitrin, ed. (Acad. Sci. USSR) Jerusalem, 1963 156 p refs Transl. into ENGLISH of the Proc. of the Moscow Seminar on Combust. held at the Energetics Inst., Acad. Sci. USSR Moscow, Izd. AN SSSR, 1959
(Sponsored by NASA and NSF)
(NASA TT F-97; OTS-62-11035) OTS: $1.50

CONTENTS:

1. CALCULATION OF FLAME PROPAGATION IN A TURBULENT FLOW E. S. Shchetinkov p 1-40 refs (See N64-13411 05-26)

2. EXPERIMENTAL INVESTIGATION OF THE COMBUSTION ZONE IN A TURBULENT FLAME K. P. Vlasov p 41-47 (See N64-13412 05-26)

3. A MODEL OF COMBUSTION IN TURBULENT FLOW S. M. Kogarko p 48-51 (See N64-13413 05-26)

4. THE EXPERIMENTAL BASIS OF THE THEORY OF TURBULENT COMBUSTION A. S. Sokolik p 52-72 refs (See N64-13414 05-26)

5. THE OPTICAL DIFFUSION METHOD OF MEASURING TURBULENCE IN AIR FLOWS AND FLAMES A. G. Prudnikov p 73-121 refs (See N64-13415 05-26)

6. STUDIES OF TURBULENT GAS FLOW IN PISTON ENGINES E. S. Semenov p 122-147 refs (See N64-13416 05-26)

N64-13411* Israel Program for Scientific Translations, Ltd., Jerusalem
CALCULATION OF FLAME PROPAGATION IN A TURBULENT FLOW (O RASCHETE RASPROSTRANENIYA PLAMENI V TURBULENTNOM POTOKE)
E. S. Shchetinkov *In its* Combust. in Turbulent Flow 1963 p 1-40 refs (See N64-13410 05-26) OTS: $1.50

A study was made of flame propagation in a turbulent flow and includes a discussion of a model of turbulent flow, methods for numerical calculation of combustion in turbulent flow, and the results of the calculations. Results are presented for the theoretical analyses of turbulent combustion, and some experimental considerations related to the microvolume combustion model are given. The method adopted for the calculation of flame propagation in a turbulent flow permits, in principle, a quantitative analysis of the effects of various parameters of the combustible mixture and the flow on such combustion characteristics as flame velocity, combustion-zone width, and the flame stability. The method is applicable only to those combustion conditions for which the microvolume combustion model is valid. C.L.W.

N64-13412* Israel Program for Scientific Translations, Ltd., Jerusalem
EXPERIMENTAL INVESTIGATION OF THE COMBUSTION ZONE IN A TURBULENT FLAME (EKSPERIMENTAL'NOE ISSLEDOVANIE ZONY GORENIYA TURBULENTNOGO PLAMENI)
K. P. Vlasov *In its* Combust. in Turbulent Flow 1963 p 41-47 (See N64-13410 05-26) OTS: $1.50

The measurement of ionization phenomena in flames for the study of the structure of turbulent flames is considered, and equipment that was used to obtain oscillograms of the ionization current is discussed. This particular equipment made it possible to record processes occurring in the combustion zone with almost no distortions. The turbulent flame was studied by the time variation of the ionization current; these

variations were measured at several successive points in the cross section of the flame, from the forward boundary of the combustion zone to the flame axis. C.L.W.

N64-13413* Israel Program for Scientific Translations, Ltd. Jerusalem

A MODEL OF COMBUSTION IN TURBULENT FLOW (O MODELI GORENIYA V TURBULENTNOM POTOKE)

S. M. Kogarko *In its* Combust. in Turbulent Flow 1963 p 48–51 (See N64-13410 05-26) OTS: $1.50

A type of combustion is discussed that deviates from the two limiting cases of combustion. It obeys neither the laws of normal combustion nor those of detonation. An example of such a process is the flame acceleration during the predetonation period in which acceleration of the flame propagation is related to the continuously increasing flow velocity and the degree of turbulence of the initial mixture ahead of the flame front. In order to obtain further insight into the mechanisms of combustion of gaseous mixture in a turbulent flow, the importance of models of combustion was recognized. In considering models of combustion in turbulent flow, attention was directed toward the model proposed by Damkohler and the one proposed by Shchetinkov. C.L.W.

N64-13414* Israel Program for Scientific Translations, Ltd., Jerusalem

THE EXPERIMENTAL BASIS OF THE THEORY OF TURBULENT COMBUSTION (OB EKSPERIMENTAL'NOI OSNOVE TEORII TURBULENTNOGO GORENIYA)

A. S. Sokolik *In its* Combust. in Turbulent Flow 1963 p 52–72 refs (See N64-13410 05-26) OTS: $1.50

This investigation of combustion covered the following areas: the laminar model of turbulent combustion; the laminar model of a fragmented turbulent combustion zone; the effect of small-scale turbulence on a flame; experiments related to the laminar model of a turbulent flame; luminosity and ionization of laminar and turbulent flames; and remarks on the nature of turbulent combustion. The need to establish a physical theory of combustion and to understand the nature of turbulent combustion was noted. The choice of a definite model of turbulent combustion is considered as the basic problem. Conditions are given which must be met before an adequate model of combustion can be secured. The solution is found in an agreement between the concepts derived from the model and the fundamental properties of turbulent fluid flow and the basic combustion laws. C.L.W.

N64-13415* Israel Program for Scientific Translations, Ltd., Jerusalem

THE OPTICAL DIFFUSION METHOD OF MEASURING TURBULENCE IN AIR FLOWS AND FLAMES (IZMERENIE OPTIKO-DIFFUZIONNYM METODOM TURBULENTNOSTI VOZDUSHNYKH POTOKOV I PLAMEN)

A. G. Prudnikov *In its* Combust. in Turbulent Flow 1963 p 73–121 refs (See N64-13410 05-26) OTS:$1.50

Results are presented of some studies of turbulence in airstreams and flames. These results were obtained by means of a new method that is a modification of the diffusion method. However, it combines the simplicity and clearness of the diffusion method with the rapidity of obtaining data characteristic of hot-wire anemometer measurements. Basic principles of the optical diffusion method are given, including the equations from the theory of turbulent diffusion and the basic formulas of the optical diffusion method. The accuracy of the optical diffusion method is also discussed as well as experimental methods and the verification of results obtained by these methods. Some measurements are presented of the turbulence of airflows in industrial tubes, including turbulence in tubes without grids and turbulence behind grids in industrial tubes. Results are given of the measurement of turbulence in flames. C.L.W.

N64-13416* Israel Program for Scientific Translations, Ltd., Jerusalem

STUDIES OF TURBULENT GAS FLOW IN PISTON ENGINES (ISSLEDOVANIE TURBULENTNOGO DVIZHENIYA GAZA V USLOVIYAKH PORSHNEVOGO DVIGATELYA)

E. S. Semenov *In its* Combust. In Turbulent Flow 1963 p 122–147 refs (See N64-13410 05-26) OTS: $1.50

This article is only a first attempt to investigate certain turbulence parameters for gas flow in a piston engine. The basic points are the following: the nature of gas flow during intake and compression and at a source of turbulence; the variation of the turbulence parameters throughout the cycle and particularly during the combustion period; the effect of certain parameters and engine operating conditions upon the turbulence and upon the frequency spectrum of the turbulent fluctuations. Author

N64-13646 Naval Ordnance Lab., White Oak, Md.

THE PREDICTION OF VERY-LOW EED FIRING PROBABILITIES

J. N. Ayres, L. D. Hampton, and I. Kabik Jan. 1964 31 p refs Presented at the 2nd HERO Congr., 30 Apr.–2 May 1963

(NOLTR-63-133; AD-426466)

EED (electroexplosive device) functioning probability levels needed for estimating weapon safety and reliability cannot be measured exactly. Existing interpretations of "all-fire" and "no-fire" levels often are seriously in error or even invalid. Practical procedures for reducing errors in estimating extreme functioning probability levels are presented—proper sampling, proper instrumentation, optimization of data collection procedures, and selection of proper statistical tools. Author

N64-13667 Picatinny Arsenal, Dover, N.J. Feltman Research Labs.

A STUDY OF THE ELECTRICAL CHARACTERISTICS OF SOME EXPLOSIVES AND EXPLOSIVE MIXTURES

Henry J. Jackson Oct. 1963 15 p refs

(PA-TM-1288; AD-425988)

An apparatus for determining the electrostatic sensitivity of explosives has been built and tested. Both the initiation energy and voltages are given in this study. The results show that tetryl is the most hazardous secondary explosive. The functioning time of conductive lead azide is shown to be related to the graphite content. It has been long realized that there is an optimum percentage of conducting material for each specific use of conductive explosives. It was reported by the Germans that chemically bound graphite of a lower percentage would be suitable for reproducible short functioning times. It was found that such graphite–lead azide composition was very difficult to prepare. The difficulty was the inability to control the amount that would be occluded, and its distribution. The high-purity colloidal lead-azide mixtures of 6 to 7 1/2% graphite possess functioning times of 1 to 2 μsec and standard deviations of 0.030 μsec. This two-component system has sufficient output to initiate tetryl and other high explosives. Author

N64-13717 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

ANALYSIS OF A DILUTE DIFFUSION FLAME MAINTAINED BY HETEROGENEOUS REACTION

George H. Markstein Charlottesville, Va. U. School of Eng. and Appl. Sci., Dec. 1963 44 p refs Presented at the AIAA Conf. on Heterogeneous Combustion, Palm Beach, Fla., 11–13 Dec. 1963
(Contract Nonr-3623(00); Proj. Squid)
(CAL-89-P; AD-425945)

The treatment is based on the usual assumptions of negligible convective transport of nozzle reactant, constant temperature and pressure in the flame zone, and absence of depletion of atmosphere reactant. Additional assumptions are: the reaction product is present only in the form of condensed-phase spherical particles that are convected by the radial flow of inert carrier gas; the rate of reaction is controlled by collision of nozzle-reactant molecules with the particle surface; nucleation of particles occurs only within a small central region of the flame and is not considered in the analysis. This model leads to a nonlinear system of two first-order differential equations, which is solved numerically. The absence of noticeable nonlinear effects in experimental results on $Mg-O_2-Ar$ flames leads to selections of these parameters which confirm the occurrence of nucleation in a central zone of the flame and which require a nucleation process that results in a broad distribution of particle size. Author

N64-13756 Franklin Inst., Philadelphia, Pa.
CATALYTIC COMBUSTION HEAT SOURCES FOR THERMAL ENERGY CONVERTERS Second Quarterly Progress Report, 1 Jul.–30 Sep. 1963
Mullapudi M. Reddi and Robert A. Baker [1963] 15 p
(Contract DA-36-039-AMC-02177(E))
(Q-B2088-2; AD-426966)

Experimental results on two vanadia catalysts are given for extended testing. During 200 hours of operation, overall oxidation efficiencies of 85% to 90% were obtained at space velocities of 24,000 hr^{-1} and 20,500 $hr.^{-1}$ Author

N64-13761 Aerospace Corp., El Segundo, Calif. Labs. Div.
MATERIALS AND STRUCTURES: HIGH-TEMPERATURE CHEMISTRY Semiannual Technical Report, 1 Jan.–30 Jun. 1963
J. E. Colwell, T. J. Dudek, T. S. Lee, F. M. Wachi, and M. T. O'Shaughnessy 20 Nov. 1963 17 p refs
(Contract AF 04(695)-169)
(TDR-169(3240-22)TR-1; SSD-TDR-63-321; AD-427230)

The work described in this report consists of studies of combustion of Teflon monomer (C_2F_4), and studies of mechanical and electrical properties of polymers. In the Teflon flame studies, CF_2 has been detected spectroscopically in both diffusion and premixed flames; CF was detected, with less certainty, in diffusion flames. Apparatus has been constructed for detecting ionization and following electron decay using an RF energy absorption method. Its application so far has been limited to propane flames. In the polymer investigations, styrene-butadiene and ethylene-propylene rubbers of graded cross-link density have been studied mechanically in tension. A swelling-deswelling technique, applied at fjxed length, has been used to design "equilibrium" stress-strain curves. A pulse method has been devised for the very rapid measurement of dielectric constant and loss and is being evaluated. Author

N64-13911 Suffield Experimental Station, Ralston, Alberta (Canada)
60 LB TNT SPHERE–SOME CASTING TECHNIQUES AND DETONATION TESTS
J. Holdsworth and W. J. Ditto 7 Aug. 1963 30 p refs
(SES-Tech. Paper 288)

Several 60-lb TNT spheres were cast in various forms, including whole, halves, and 16 segments. They were tested for detonation velocity and symmetry when initiated from the center. Progressively higher and more uniform velocities were measured through five types of cast charge, the highest velocities being obtained with the 16 segments. Author

N64-13933 Army Missile Command, Huntsville, Ala.
THE CHARACTERIZATION OF SOLID ROCKET PROPELLANTS BY DIFFERENTIAL THERMAL ANALYSIS
J. D. Burnett and A. F. Findeis 17 Sept. 1963 31 p refs
(RK-TR-63-21; AD-423152)

Differential thermal analysis (DTA) is described for the characterization of solid rocket propellants. Variables, such as sample size and heating rates, are discussed. A DTA apparatus is tested and recommended for routine characterizations of a wide variety of propellant materials. Author

N64-14024 Stanford Research Inst., Menlo Park, Calif.
SOLID PROPELLANT MECHANICAL PROPERTIES INVESTIGATIONS Final Report, 1 Jun. 1962–31 May 1963 [and] Quarterly Progress Report No. 4, 1 Mar.–31 May, 1963
Norman Fishman and James A. Rinde 6 Nov. 1963 57 p refs
(Contract AF 04(611)-8388)
(SRI-12; AD-426094)

Dilatometric studies were undertaken to evaluate the mechanical response of a polyurethane and a carboxy-terminated polybutadiene composition by extension at constant strain rates and constant loads. The effects of strain rate, load, temperature, and humidity were investigated. Mechanisms of propellant dilatation were postulated on the basis of three regions of behavior. The first region was exemplified by the linear viscoelasticity of filled rubber; the second region was considered to consist of dewetting, with binder–particle bond rupture and retardation due to frictional forces at the binder–particle interface having the greatest influence on response; the final region was thought to behave primarily in the manner of a filled, dewetted foam. Some observations of propellant mechanical behavior were made on the basis of postulated mechanisms and interactions. Author

N64-14087 Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
CHARACTERISTICS OF DIBORANE FLAMES
H. G. Wolfhard, A. H. Clark, and M. Vanpee Charlottesville, Va. U., Nov. 1963 25 p refs Presented at the AIAA Conf. on Heterogeneous Combust., Dec. 1963
(Contract Nonr-3623(00); Proj. Squid)
(RMD-3-P; AD-424858)

The high temperature reactions of boron compounds in flames were investigated. The measurements reported are mainly concerned with burning velocities and the radiation emitted from the flames. Limits of flame propagation for diborane or pentaborane are very wide indicating very low limit temperature. This fact allows greatly diluted or very lean fuel flames to be burnt at one atmosphere on sintered discs. The undiluted diborane air flame, in contrast, has a quenching diameter which is only a small fraction of a millimeter. The burner method for diborane-air as well as an investigation of spherical flame propagation using pentaborane-air yielded about 5 m/sec. This is the highest burning velocity ever measured with air and compares with hydrogen-air: 3 m/sec; acetylene-air: 1.5 m/sec and methane-air: 0.4 m/sec. R.T.K.

N64-14106 Naval Ordnance Lab., White Oak, Md.
RUBY CODE CALCULATION OF DETONATION PROPERTIES I. C-H-N-O SYSTEMS
Donna Price and Harold Hurwitz Feb. 1964 38 p refs
(NOLTR-63-216; AD-427379)

The RUBY code has been used to compute detonation properties for 23 solid, high explosives (pure compounds), 5 liquids, and several mixtures at loading densities of TMD (the theoretical maximum density) and 0.95 TMD. It was found that the BKW equation-of-state parameters now in the code are adequate for many high explosives, but should be replaced by a recently available newer set of parameters to obtain good agreement between computed and experimental results for the larger variety (in oxygen balance) of high explosives. The detonation properties of the solid mixtures can be computed from those of the pure components. The energy release exhibited by burning and by detonation is of the same order of magnitude, and the limit of the release in confined burning at high pressure is the detonation release. Author

N64-14129 Boeing Scientific Research Labs., Seattle, Wash.
DETERMINATION OF INDUCTION TIMES IN ONE-DIMENSIONAL DETONATIONS
G. J. Mullaney and R. Arave Dec. 1963 26 p refs
(Flight Sci. Rept.-87; DI-82-0324)

One-dimensional detonations are established in a converging–diverging nozzle at low initial pressures. Pulsed light schlieren photography displays the shock wave and the density gradient that signals the beginning of rapid chemical reaction after the induction period. Induction time (τ) has been studied over the ranges $880 \leq T \leq 1600°$ K, $15 \leq p_1 \leq 40$ mmHg, and $2.5 \leq \tau \leq 21$ μsec for the hydrogen–oxygen reaction. Data are presented mostly for $2H_2 + O_2 + 3.76N_2$ and $2H_2 + O_2 + 4A$ and compared with that obtained theoretically in other kinetic studies. Schlieren photographs taken when a weak shock passes over the combustible mixture show some of the features of detonation formation. Author

N64-14136 Rocketdyne, Canoga Park, Calif.
STUDY TO FIND SIMULANTS FOR FUELS FOR USE IN STRUCTURES FATIGUE TESTING Technical Report April. 1962-Jan. 196
W. Bisbee et al Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Nov. 1963 181 p refs
(Contract AF 33(657)-7901)
(ASD-TDR-63-405; AD-427123)

Several of the physical properties of simulants for five liquid propellants and one solid propellant were compared with those of the particular propellant over a wide temperature range. The materials selected as simulants duplicate to a great extent the properties of the "live" ingredients while being neither a toxicity nor a fire hazard. Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-13497 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany)
THE DETERMINATION OF THRUST OF ELECTRODELESS MAGNETOHYDRODYNAMIC ENGINES [ÜBER DIE BESTIMMUNG DES SCHUBES VON ELEKTRODENLOSEN MAGNETOHYDRODYNAMISCHEN TRIEBWERKEN]
H. Wichmann [1963] 23 p refs In GERMAN

The thrust of an electrodeless MHD accelerator can be measured indirectly by recording the momentum of the accelerated plasma on a ballistic pendulum in conjunction with the ensuing mathematical calculations. However, for proper accelerator efficiency, and thus proper thrust measurement, preionization must be sufficiently strong for a plasma acceleration in the first half-cycle of the winding so that the discharge energy can be fully utilized. As this energy increases, the momentum and the velocity of the plasma increase. I.v.L.

N64-13596 Marquardt Corp., Van Nuys, Calif.
CY 1963 RAMJET TECHNOLOGY PROGRAM. VOLUME II OF III: RAMJET STRUCTURAL COMPONENT INVESTIGATIONS Third Quarterly Progress Report, 12 Aug.-3 Nov. 1963
J. R. Campbell Nov. 1963 75 p refs
(Contract AF 33(657)-12146)
(Rept. 25109; AD-424980)

The following topics are discussed: (1) ramjet structural elements—high-temperature material systems for use as ramjet components; (2) nonregeneratively cooled combustion chambers and nozzles—radiation-cooled chambers and nozzles and film-cooled nozzles; and (3) high-temperature coated tungsten structures—the development and evaluation of protective systems capable of providing high-temperature oxidation and erosion resistance for tungsten structural components, and analytical and experimental studies of the material systems and fabrication techniques to provide high-temperature utilization of tungsten. R.T.K.

N64-13782 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
PERFORMANCE OF WAKE-ADAPTED PROPELLERS IN OPEN-WATER AND PROPULSION CONDITIONS AS DETERMINED BY THEORY AND EXPERIMENT
John L. Beveridge Nov. 1963 21 p refs
(DTMB-1777; AD-408315)

Some important considerations and concepts concerned with determining propeller performance in open-water and propulsion (behind-body) conditions are discussed. Two wake-adapted propellers were designed by the Eckhardt-Morgan method using Lerbs' theory of moderately loaded propellers. Performance of these propellers in open-water and wake-adapted conditions was calculated by the Burrill method. For the examples of a submerged body of revolution and a single-screw surface ship, relative rotative efficiencies as obtained by theory and model experiment are shown to be in good agreement. Author

N64-13886 Rocket Power, Inc., Pasadena, Calif.
STUDY OF ROCKET ENGINE EXHAUST PRODUCTS Second Annual Summary Report, 1 Jul. 1962-31 Jul. 1963
M. A. Greenbaum, R. Yates, M. Arshadi, M. L. Arin, M. Wong et al [1963] 38 p refs
(Contract AF 04(611)-7414)
(AD-427694)

Some thermodynamic properties of $BeF_2(g)$, $BeCl_2(s)$, BeCl(g), BeO(s) and $Be_3N_2(s)$ were determined. A table summarizes the work completed during the past year. Third law

calculations as well as the thermodynamic values reported at 298° K have employed the latest data reported in the JANAF Tables. Author

N64-13986 Aeronutronic, Newport Beach, Calif.
BEHAVIOR OF ROCKET NOZZLE MATERIALS AT HIGH TEMPERATURES AND PRESSURES OF COMBUSTION PRODUCT GAS MIXTURES Final Technical Report, 15 May 1962-15 Dec. 1963
A. M. Saul, W. L. Smallwood, R. W. Bartlett, R. M. Hale, J. T. Hall et al 15 Dec. 1963 107 p refs
(Contract NOw-61-0905-c; ARPA Order 22-62)
(U-2403; AD-427109)

Experiments were conducted to define the extent and rates of nozzle material interaction with combustion product gases as a function of two of the variables of the rocket environment, temperature, and pressure. The following were investigated: (1) recession rates for various nozzle-throat refractory materials in gaseous combustion products at high temperatures and at high pressures; (2) reactions between liquid reaction products and various refractory nozzle materials; and (3) the behavior of these nozzle materials under dynamic conditions using simulated gaseous combustion products in an arc plasma facility. Secondary injection and mixing were used to incorporate other species into the arc jet stream. Author

N64-14025 Pratt and Whitney Aircraft, East Hartford, Conn.
FEASIBILITY DEMONSTRATION OF A ROTARY REGENERATOR FOR AIRCRAFT GAS TURBINES
H. J. Selfors [1963] 49 p
(PWA-2174, Suppl. A; AD-412443)

Additional work has substantiated the feasibility of the toroidal rotary regenerator configuration. This testing demonstrated an improvement in regenerator performance with the result that effectiveness goals have been realized. In addition, component rig tests of seals have shown that the leakage goals can be reached with minor modification of the ring seal liner support. Author

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-13647 Air Force Cambridge Research Labs., Bedford, Mass. Office of Aerospace Research
SOLAR FLUX MEASUREMENTS AT 915 Mc DURING PARTIAL ECLIPSE OF 20 JULY 1963
Richard J. Miner Oct. 1963 21 p refs
(AFCRL-63-796; AD-426686)

A 95% optical eclipse occurred at Hanscom Field. Data of the day of the eclipse and the day after are presented. An eclipse of 85.6% of the solar flux was observed. Two areas of high solar flux radiation are identified near the limbs of the sum from the rate of change of the received flux during the eclipse. A calculation of true solar flux is made. A series of photographs are displayed which were made using 6-in.-reflector optical telescope. Author

N64-13721 Texas U., Austin Electrical Engineering Research Lab.
SOLAR RADIATION AT 3.2 MM DURING THE 20 JULY 1963 ECLIPSE Scientific Report No. 1
C. W. Tolbert, L. C. Krause, and A. W. Straiton Bedford, Mass. AFCRL, 15 Nov. 1963 21 p refs
(Contract AF 19(628)-1679)
(Rept. 6-57; AFCRL-63-900; AD-425488)

While the measurements were restricted by inclement weather, the observations by circularly scanning the limbs of the moon over a period of ±10 minutes of the maximum occultation showed strong radiation from southeastern and southwestern limb prominences and no systematic limb brightening for the solar conditions at the time of the eclipse. Author

N64-13779 Bendix Corp., Ann Arbor, Mich.
SOLAR FLARE RADIATION SURVEY
L. R. Lewis, G. M. Brown, J. Gabler, and R. M. Magee Kirtland AFB, N. Mex., Res. and Tech. Div., Dec. 1963 63 p refs
(Contract AF 29(601)-5224)
(RTD-TDR-63-3044; AD-427031)

Empirical characteristics of solar-flare emissions are reviewed from the data available in scientific literature. Optical and corpuscular flare classification systems are discussed. Those emissions recognized as potential hazards to astronauts protected by only moderate shields have been given special attention. Hence, solar proton events are described in detail, including frequency of occurrence, correlation with PCA's, propagation models, temporal characteristics (arrival times, rise times, duration, decay), spatial distribution, and energy spectra. The cases in which alpha particles and charged heavy nuclei have been detected are presented, as are the observations of electron and gamma-ray fluxes reported in the literature. Solar-flare radio emissions are discussed in relation to their possible elucidation of the solar physics processes involved in flare phenomena and in recognition of possible particle-event prediction schemes based upon their observation. Author

N64-13780 Bendix Corp., Ann Arbor, Mich.
SOLAR FLARE STAELLITE DESIGN STUDY Final Report
L. R. Lewis, G. M. Brown, B. H. Colmery et al Kirtland AFB, N. Mex., AF Weapons Lab., Dec. 1963 317 p refs
(Contract AF 29(601)-5224)
(RTD-TDR-63-3010; AD-427035)

A study was made of the characteristics required for a satellite to evaluate the solar flare hazard to near-earth manned space missions. The most important parameters to be measured in the space radiation environment were determined, and an instrumentation package was selected from existing instruments or instruments under development. In those instances where instruments were not available, preliminary designs of recommended instruments are presented. A preliminary designs of recommended instruments are presented. A preliminary overall satellite system was designed, and a preliminary design iteration was made on all satellite subsystems to determine possible problem areas. Author

N64-14061 California U., Livermore. Lawrence Radiation Lab.
COSMIC RAYS FROM LARGE SUPERNOVAE
S. A. Colgate and R. H. White 21 Oct. 1963 23 p refs
(Contract W-7405-eng-48)
(UCRL-7551)

The mechanism of Type II supernova explosions has been followed with a hydrodynamic computing code from the time

of gravitational collapse to reversal of the core velocity due to the equation of state derivable from the nucleon hard-core potential. The inverse beta decay neutrino flux cools the core during implosion, but the partial deposition in the stellar envelope of this flux, plus that from the reflected shock wave, assures sufficient energy to eject 80% of the mass of the star. The resulting shock wave is strong enough so that, in the density gradient of the envelope, it ejects matter at $\geq$ 1 Bev for $\rho \leq 10^4$ g/cm^3. The total energy of 10^{51} ergs is 10^3 greater than previously assumed, and because the initial density is greater, the material in the region of 1 Bev will have partially completed nuclear synthesis up to the ion group. The upper energy limit of the shock acceleration becomes 3×10^{16} ev for a radiation shock and 2×10^{19} ev for a plasma oscillation shock. Author

N64-14065 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
COSMIC RAY HAZARDS IN THE SOLAR SYSTEM
S. N. Milford [1964] 14 p refs Presented at the AIAA Aerospace Sci. Meeting, N.Y., 20–22 Jan. 1964
(AIAA Paper 64-66) AIAA: $0.50 members, $1.00 nonmembers

The topics covered are: (1) cosmic rays near the earth—underground, sea level, and altitudes within the earth's atmosphere and outside the earth's atmosphere but within the geomagnetic field; (2) cosmic ray measurements in the inner solar system; (3) cosmic rays and secondaries near the moon and planets; (4) cosmics rays in the outer solar system—information from meteorites, high-energy cosmic rays, theoretical estimates of the intensity of low-energy cosmic rays; and (5) radiation dose rates from cosmic rays in the solar system. R.T.K.

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-13473 Technische U. Berlin (W. Germany)
INTERPLANETARY TRAJECTORY OF LOW CONSTANT THRUST ACCELERATION [INTERPLANETARE FLUGBAHNEN KLEINER SCHUBBESCHLEUNIGUNG MIT KONSTANTEM SCHUB]
E. Rössger and H. Zehle Oct. 1963 156 p refs In GERMAN
(Rept. 26)

Some of the advantages of low constant-thrust propulsion over impulse propulsion are discussed, possible propulsion principles are illustrated, and an analysis is made of the weight ratio of spacecraft with a separate energy-generating system. A variational problem arises from the requirement of making the payload as large as possible. In the case of constant thrust, this problem is carried over to the requirement of minimal journey time. The differential equations of motion of the spacecraft add nonholonomic secondary conditions to the variational problem. The differential equations of time-minimized flight with constant thrust are derived with the help of Lagrange's factors. These equations, along with the launch and mission conditions, create a boundary value problem. In solving this problem, the planet orbits are assumed as coplanar circles. In conjunction with the solution, interplanetary flight is discussed in regard to cases of a predetermined launch-time point in the synodical year as well as an open launch date. This second case leads to an absolute time-minimized flight; the necessary specialization of the general equation is given for the direct calculation. An aid to solution is given in the form of a zeroth approximation. In addition, a practical solution to interplanetary flight is discussed whereby digital and analog calculation of a Mar's flight is described. Trans. by I.v.L

N64-13495* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ITERATIVE GUIDANCE SCHEME FOR ASCENT TO ORBIT (SUBORBITAL START OF THE THIRD STAGE)
Isaac E. Smith and Emsley T. Deaton, Jr. 29 May 1963 39 p refs
(NASA TM X-51383; MTP-AERO-63-44) OTS: $3.60 ph, $1.37 mf

Average gravity magnitude and direction approxiamtions allow a closed-form solution to the equations of motion. The solution yields a time-to-go before cutoff as well as a steering function, consisting of a thrust attitude and a thrust attitude turning rate. The principles of the guidance scheme, which is adaptive for a set of large disturbances, are outlined with a constant gravity. A spherical earth model extension, which includes staging during the guidance phase, is presented. Performance data and a comparison of trajectory shaping are included where the comparison is against the theoretical optimum classical calculus of variations solution. Author

N64-13593 Smithsonian Astrophysical Observatory, Cambridge, Mass.
PERIODIC ORBITS OF A PLANETOID PASSING CLOSE TO TWO GRAVITATING MASSES
Robert R. Newton (APL) 1959 13 p refs
(*Its* Contrib. to to Astrophysics, v. 3, no. 7) GPO: $0.20

This paper presents a study of periodic orbits in the restricted three-body problem in which the small mass passes close to each of the large masses. The orbits are classified according to the types of motion involved, and methods are given for estimating initial conditions for the various classes of orbit. Some sample orbits, as determined by a digital computer, are presented. Author

N64-13670 Wolf Research and Development Corp., West Concord, Mass.
CALIBRATION SATELLITE SYSTEM STUDY Final Report
M. Richard Harris et al 6 Nov. 1963 83 p refs
(Contract AF 19(628)-3258)
(AFCRL-63-920; AD-426799)

This report contains the results of a study program conducted on the primary features of a calibration satellite system. It gives consideration for the satellite, booster, tracking stations, and ground station equipment, as well as all operational requirements including digital computer programs and data links necessary to effect a calibration. Author

N64-13702* National Aeronautics and Space Administration, Washington, D.C.
THE MANNED LUNAR BASE
G. A. Smith *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq. Vol. 3, No. 3 Nov. 1963 p 3-9 (See N64-13701 05-01)

Our nation's current and future space missions may be classified as those planned for orbit and for the regions of the moon and planets. Of primary importance is the establishment of a manned lunar base for scientific exploration of the

moon and exploitation of the lunar environment. A lunar station, whether an Apollo stay-time extension, or a permanent or semipermanent base, could also provide essential data and support for future, more complex planetary expeditions. Studies have been conducted to determine the life-support requirements and special facilities, including transportation, communication, and power necessary to maintain such a base. A review is made of the current thinking among qualified scientists regarding man's role in lunar and planetary exploration. It is generally concluded that the immediate training of scientist-astronauts is necessary to achieve and maintain pre-eminence in space. Author

N64-13703 Griffith Observatory, Los Angeles, Calif.
IMPORTANT EXPERIMENTS IN ASTRONOMY TO BE CONDUCTED ON THE MOON
Dinsmore Alter *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 11–14 ref (See N64-13701 05-01)

Five reasons are offered for going to the moon: political, military, commercial, space exploration economy, and the simple challenge of getting there. But, the primary reason is the scientific and technical advantages to be gained which affect the future of the human race. Of particular significance are important experiments in astronomy to probe clearer and deeper into near and far space. Author

N64-13704 Space Technology Labs., Inc., Los Angeles, Calif.
THE LUNAR ATMOSPHERE AND ITS RELATIONSHIP TO THE SOLAR WIND
W. Bernstein, R. W. Fredricks, and J. L. Vogl *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3, Nov. 1963 p 15–21 refs (See N64-13701 05-01)

Several possible lunar model atmospheres and ionospheres are computed; the gases considered are hydrogen, nitrogen, neon, argon, krypton, and xenon. The contributions from the lunar surface and the solar wind are discussed. Various atmospheric loss processes as a result of the solar wind interaction, including scattering, electrostatic acceleration, and magnetic field attachment, are included. The reasonable model atmospheres are in agreement with estimates of the density derived from radio-astronomy measurements. Author

N64-13705 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE PHYSICAL NATURE OF LUNAR SURFACE MATERIAL
Albert R. Hibbs *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3, Nov. 1963 p 23–28 refs (See N64-13701 05-01)

The fraction of lunar material which has not been subject to melting and that fraction which has been subject to vaporization and redeposition as a result of impacts (even if originally solidified from a melt) should be deposited on the surface of the moon in the form of whisker crystals or needles. This result was indicated by laboratory experiments on the condensation of material from a vapor to a solid phase in a region of pressure and temperature that precludes a liquid phase and that would apply to material condensing from the vapor to a solid phase on the surface of the moon or, generally, in interplanetary space. Author

N64-13707 North American Aviation, Inc., Downey Calif. Space and Information Systems Div.
CONCEPTS OF BASE CONSTRUCTION ON THE MOON
George W. S. Johnson *In its* Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 31–37 refs (See N64-13701 05-01)

A lunar base will be used for exploration, and for equipment development and testing. It will be the forerunner of future bases on the planets, or their satellites. As such, it should develop techniques for living-off-the-land, thus reducing logistical supplies from earth. Examining the functions indicates that the base must be dispersed over an area of several miles, thus requiring a manned surface vehicle. A power, or energy source, may be the pacing item in base utilization. Ore-processing equipment for obtaining water, and subsequently hydrogen and oxygen by electrolysis, is probably of next importance. However, more knowledge about the lunar surface is urgently needed to make meaningful design studies of lunar bases. Author

N64-13708 Little (Arthur D.) Inc., Cambridge, Mass
THE IMPLICATIONS OF WATER AS A LUNAR RESOURCE
Peter E. Glaser, Alfred E. Wechsler, and John W. Salisbury (AFCRL) *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 39–53 refs (See N64-13701 05-01)

Lunar water deposits, when economically exploited, can play an important role in the logistics of space exploration. Evidence is given to support the existence of surface and subsurface water deposits. The physical properties of possible water deposits are discussed, and their influence on possible recovery methods is indicated. Energy sources and water extraction processes are categorized as: (1) in situ processes with direct application of heat; (2) in situ processes requiring remote power sources; (3) in situ processes requiring no primary energy sources; and (4) processes using mined deposits. The utilization of nuclear and solar energy for these processes is considered. Author

N64-13709 Texas Instruments, Inc., Dallas
EXPLORATION FOR LUNAR WATER DEPOSITS
J. R. Van Lopik and K. Westhusing *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 55–63 refs (See N64-13701 05-01)

The locating of lunar water deposits is critical to any extensive, lunar-based program of scientific investigation in space. Exploration for water on the moon will use tools of terrestrial exploration, both contact and noncontact techniques, which will generate "converging" data to delineate deposits. Techniques which hold particular promise for work in either lunar meteorite or volcanic terrains are: multiband remote-sensing techniques (e.g., visual, infrared, and radar), and the on-surface geophysical methods, such as electrical resistivity, nuclear activation, gravity-magnetic traversing, and seismic profiling. Author

N64-13710 Douglas Aircraft Co., Inc., Santa Monica, Calif.
SOME ASPECTS OF LUNAR SOIL BEHAVIOR
J. A. Ryan *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 65–71 refs (See N64-13701 05-01)

The possible effects of vacuum upon soil behavior are discussed. Emphasis is given to the role the lunar soil may play in a lunar basing operation. It is concluded that the lunar soil may behave in a manner unlike that of any terrestrial soil. Hence, caution must be exercised in the choice of the terrestrial soil-mechanics equations which may adequately describe this

soil's behavior. In addition, it is concluded that possible adhesion between the soil and engineering materials poses a serious problem to any lunar basing operation. Author

N64-13711 Princeton U., N.J.
ARCHITECTURE OF THE LUNAR BASE
William R. Sims *In* North American Aviation, Inc. Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3, Nov. 1963 p 73–81 refs (See N64-13701 05-01)

Architecture is defined as an expression of man's needs in relation to his physical environment. A moon base should express human needs if simply to avoid a machine environment. An architectural design for a particular base site is presented, having application regardless of technological changes. Use is made of existing lunar-like earth terrain in a design analogy, which includes necessary quarters, equipment, and human expression into a long-term lunar base. Author

N64-13712 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
SOME LUNAR RESOURCES
Jack Green *In its* Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 83–95 refs (See N64-13701 05-01)

Volcanic terrains offer more survival advantages in lunar basing than impacted terrains. Therefore, calderas should be sought on the moon regardless of whether they occupy 1 percent or over 95 percent of the lunar surface. Such volcanic areas would contain easily worked materials, such as nonwelded tuffs or lava tubes, for housing or protection. Rock types suitable for casting purposes may be found on the lunar maria. Volcanic rocks would be variably hydrous but, on the average, wetter than meteorite rocks. Epithermal logging techniques would be valuable in locating hydrous deposits, especially in topographically low portions of volcanic basins. Mineralization in quantities realistic for lunar basing purposes is found in volcanic terrains and includes sulfur, alunite, pyrite, and other hydrothermal products. Subsurface heat useful in lunar basing would be likely in certain lunar calderas, volcanoes, or in recent fracture zones that ray patterns may represent. Author

N64-13713 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
THE MANNED ORBITAL SPACE STATION
J. L. Friend *In its* Proc. of the [13th] Lunar and Planetary Exploration Colloq., Vol. 3, No. 3 Nov. 1963 p 97–100 (See N64-13701 05-01)

Discussions on the feasibility of a cooperative manned orbital space station that could be used for testing purposes are presented. Some of the opinions expressed during these discussions are: (1) This type of station is the only means by which the earth's gravity can be negated and a true coriolis effect can be obtained. (2) The U.S. could provide means for launching vehicles to a national platform in space, and permit other countries access to this space station for launching of vehicles for either earth-orbital or lunar and planetary purposes. (3) The space station is the key to developing a good logistics system regardless of whether it is orbital, lunar, or interplanetary space. The development of techniques to assemble and launch from the space station will provide a more economical logistic system for performing all of the Nation's missions in space. (4) The physiological effects of space on man should be more thoroughly understood before sending men to space stations. I.v.L.

N64-13719 Bell Aerosystems Co., Buffalo, N. Y.
STUDY OF REQUIREMENTS FOR THE SIMULATION OF RENDEZVOUS, AND DOCKING OF SPACE VEHICLES Technical Documentary Report, Apr. 1962–Jul. 1963
John M. Ryken, Jerome E. Emerson, George T. Onega, and James L. Bilz Wright-Patterson AFB, Ohio, Behavioral Sci. Lab., Oct. 1963 185 p refs
(Contract AF 33(657)-8620)
(AMRL-TDR-63-100; AD-425499) OTS: $3.50

A complete simulation of a representative automatically-controlled rendezvous and docking system was formulated and programed on an IBM-7090 digital computer. Sufficient flexibility was incorporated into this simulation so that the proposed rendezvous and docking techniques could be studied. Mission runs were made covering terminal guidance, docking, departure, retro, and deorbit to the earth's atmosphere. A simplified simulation of rendezvous and docking was programed on analog computers and coupled with a cockpit simulator. This simulation included an electronic image generation of a target vehicle as viewed by an astronaut through a window in the interceptor vehicle. Information on accuracy of this simulation, pilot control capabilities, and control techniques was obtained. Author

N64-13842 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.
A GRADIENT TECHNIQUE FOR DETERMINATION OF OPTIMUM STEERING PROGRAMS
U. E. Lapins 6 Dec. 1963 51 p refs
(Contract AF 04(695)-269)
(TDR-269(4550-20)-1; SSD-TDR-63-296; AD-426105)

A gradient technique for optimizing steering functions has been developed based on a point mass three-degree-of-freedom trajectory simulation. The optimization technique is applicable to multistage vehicles with a total of up to five powered and coasting trajectory arcs if the endpoints of the arcs, excluding the final point, are fixed. The vehicle parameters and the initial conditions must be completely defined, and they are constant in the optimization process. The optimization procedure modifies the steering functions on successive trajectories towards satisfaction of all constraints and an extremum in the payoff function. The payoff function and constraints can be selected from a group of 15 functions evaluated at the end of the trajectory. By use of special penalty functions, certain inequality constraints can be imposed for the entire trajectory. Author

N64-13862 Emmanuel Coll., Boston, Mass.
MULTIPLE COHERENT SCATTERING OF OPTICAL RESONANCE RADIATION APPLIED TO THE 6^3P_1 LEVEL OF MERCURY, PART 1: THEORY
J. P. Barrat Bedford Mass., Hanscom Field, AFCRL, Apr. 1963 25 p refs Transl. into ENGLISH from J. Phys. Radium (Paris), Vol. 20 (5), 1959 p 541–548
(Contract AF 19(604)-8505)
(E-T-F-63-1; AD-415389)

Imprisonment of optical resonance radiation leads to perturbations in lifetime measurements of atomic excited states (narrowing of magnetic resonance lines observed by the double resonance method). A formalism is developed to account for the effect of the radiation field on the atomic excited states. By applying this method to the case of a single atom, one finds the well-known results concerning single scattering. In the case of two atoms, the equations obtained for the time variation of the probability amplitudes of the excited states are coupled by coefficients that are seen to represent the transmission of the excitation from one atom to another by means of an optical photon (multiple scattering). Author

N64-13863 Emmanuel Coll., Boston, Mass.
MULTIPLE COHERENT SCATTERING OF OPTICAL RESONANCE RADIATION APPLIED TO THE 6^3P_1 LEVEL OF MERCURY, PART 3: EXPERIMENTAL RESULTS
J. P. Barrat Bedford, Mass., Hanscom Field, AFCRL, May 1963 30 p refs Transl. into ENGLISH from J. Phys. Radium (Paris), Vol. 20(7), 1959 p 657–668
(Contract AF 19(604)-8505)
(E-T-F-63-3, Pt. 3; AD-415383)

The results of the theory developed in two preceeding papers have been checked experimentally, in the case of multiple scattering of photons of the line 2537 A ($6\,^1S_0$—$6\,^3P_1$) by mercury atoms. The degree of polarization of the resonance light and the apparent lifetime ("coherence time") of the 6^3P_1 level have been measured, in the case of selective excitation of an even isotope or of one of the hyperfine levels of the odd isotopes, as functions of the number of atoms/cm^3 that effectively scatter the radiation, for fixed geometrical conditions. Effects due to variation of geometrical conditions have also been studied, as well as the width and the shape of the magnetic resonance lines in the case of double scattering. Experimental results are generally in good agreement with theoretical expectations. Author

N64-13914* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SCIENTIFIC INSTRUMENTS IN SPACE EXPLORATION
Raymond L. Heacock Repr. from Science, v. 142, no. 3589, 11 Oct. 1963 p 188-195 refs
(NASA Contract NAS7-100)
(NASA CR-55314; JPL-TR-32-525)

In discussing scientific instruments for space exploration, it is concluded that these instruments must be designed to meet the scientific objectives under adverse environmental conditions and within the constraints of a complex spacecraft system. The limitations of weight, power, telemetry, integration, and reliability must be assessed and appropriately dealt with in the design, development, fabrication, testing, and calibration of the instrument. The instrument must operate satisfactorily in a vacuum-thermal environment for long periods after having been subjected to extreme shock and vibration during the launch and injection sequences. P.V.E.

N64-13928* Boston U., Mass.
INTERSECTIONS OF LUNAR CRATERS Research Report No. 6
David Friesen Sep. 1963 12 p refs
(NASA Grant NsG-246-62)
(NASA CR-55274) OTS: $1.60 ph, $0.80 mf

An examination was made of the intersection frequency of lunar craters by other craters for both large and small craters in the highland region. A theoretically expected frequency was calculated and compared with the actual frequency measured from the Boston University Catalog of Lunar Craters. A close agreement was found between the calculated intersection frequency and the actual frequency. R.T.K.

N64-14006 Lincoln Lab., Mass. Inst. of Tech., Lexington
STATISTICS OF VISIBILITY IN SATELLITE COMMUNICATION SYSTEMS
C. L. Mack, Jr. 12 Sep. 1963 32 p refs
(Contract AF 19(628)-500)
(Rept. 36G-7; AD-422340)

The methods used to calculate the statistics of satellite visibility are discussed. Results are given to illustrate the effects of altitude and choice of orbit on the number of satellites that must be placed in orbit. Some statistical consequences of shared use are given, and some benefits of nonrandom satellite disposition are demonstrated. Author

N64-14012 RAND Corp., Santa Monica, Calif.
ON EXOSPHERIC DRAG AS THE CAUSE OF THE SUPPOSED SECULAR ACCELERATIONS OF PHOBOS
G. F. Schilling Dec. 1963 18 p refs
(Contract AF 49(638)-700)
(RM-3939-PR; AD-426148)

A recent theory by Shklovskiy explained the supposed orbital accelerations of Phobos by suggesting that it is an artificial satellite of Mars. Reasonable assumptions about the physical state of the equatorial exosphere of Mars, however, lead to values of atmospheric density that could exert observable drag effects on Phobos without it having to be a hollow sphere. It is further shown that a required correlation appears to exist between solar activity and reported values of the accelerations over a period of some 60 years. Author

N64-14085 RAND Corp., Santa Monica, Calif.
A CALCULATOR FOR SATELLITE GROUND TRACKS
F. S. Nyland Dec. 1963 19 p refs Separate envelope containing a "Satellite Ground Track Calculator" consisting of a base map and 4 overlaps
(Contract AF 49(638)-700; Proj. RAND)
(RM-3741-PR; AD-427225).

The graphical ground-track calculator is designed to provide quick approximations of the ground paths of satellites in circular or nearly circular orbits. Examples which demonstrate practical applications are included. Author

N64-14093 Philco Corp., Palo Alto, Calif. Western Development Labs.
SPECIAL PARAMETER TRACKING SIMULATION STUDY, VOLUME III-SUMMARIZATION MATERIAL
31 Jan. 1963 80 p
(Contract AF 04(695)-113)
(WDL-TR1943, Vol. 3; AD-400130)

This volume is the third in a series prepared for use as a Design Trade-Off Handbook for error propagation in orbit determination. Using these three volumes, conclusions concerning the effects on down-range prediction accuracy of many pertinent variables can be determined. Author

N64-14103 Aeronautical Systems Div., Wright-Patterson AFB, Ohio
APPLICATION OF AERODYNAMIC LIFT IN ACCOMPLISHING ORBITAL PLANE CHANGE
Roland N. Bell and Wilbur L. Hankey Sep. 1963 54 p refs Presented at ASD Sci. and Eng. Symp., Wright-Patterson AFB, Ohio, 18–19 Sep. 1963
(ASD-TDR-63-693; AD-427130)

This study considers the concept of a hypersonic glider-type spacecraft utilizing its aerodynamic maneuvering capability in performing orbital plane change. An optimization procedure is developed for lifting vehicles that defines the proper vehicle attitude, propulsion utilization, and sequence of operations to produce the maximum plane change for a given fuel expenditure. The results are compared with the fuel requirements for a pure propulsion (nonlifting) plane change while remaining in orbit. Specifically, the optimum bank angle, angle-of-attack, entry angle, thrust alignment, and thrusting procedures are defined. The advantages of high L/D vehicles are graphically

illustrated. The method is more efficient than the pure propulsion method but is far more complex and requires longer times to execute. Author

N64-14148 Joint Publications Research Service, Washington, D.C.
PLANET MARS DISCUSSED IN POPULAR SCIENCE ARTICLES
M. G. Mikhaylov, comp. et al 24 Jan. 1964 37 p refs Transl. into ENGLISH of 9 articles from the booklet "Mars", Moscow, Znaniye Publishing House, 1962 p 3–22 and 47–63
(JPRS-22878; OTS-64-21375) OTS: $1.00

Russian popular science articles presented are: (1) Mysteries of the Planet Mars; (2) What We Know about the Planet Mars; (3) Nature on the Mysterious Planet; (4) The Bowels of the Planet Mars; (5) The Assault upon Space; (6) The Most Difficult Thing To Do Is To Forecast; (7) Thoughts about Mars; and (8) Data on Our Neighbor in Space. Also, a bibliography of Russian literature concerning Mars is presented. I.v.L.

N64-14152* California U., La Jolla, Calif.
REMARKS CONCERNING THE CHEMICAL COMPOSITION OF THE ATMOSPHERE OF VENUS
Hans E. Suess Oct. 1963 12 p refs Submitted for Publication
(NASA Grants NsG-322-63 and NsG-317-63)
(NASA CR-55367) OTS: $1.60 ph, $0.80 mf

It is still impossible to decide, on the basis of observational facts, whether the atmosphere of Venus is oxidizing, or reducing. Also, cosmochemical considerations do not lead to a conclusive answer to this important question. The atmosphere of Venus appears to be much more dense than that of the Earth. For several reasons, it seems probable that the main constituent of the dense atmosphere is neon. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-13448 Advisory Group for Aeronautical Research and Development, Paris (France)
EARTH-LANDING SYSTEMS FOR MANNED SPACECRAFT
J. W. Kiker, J. B. Lee, and J. K. Hinson (NASA. Manned Spacecraft Center, Houston) Apr. 1963 51 p
(AGARD-446)

A review is given of the guidelines employed in the selection of earth-landing systems for the Mercury, Gemini, and Apollo Command Module spacecrafts. The development and qualification programs of the Mercury spacecraft landing system, including the conical, ribbon, drogue parachute, the ringsail main and reserve parachutes, the impact skirt attenuation system, and the deployment methods are discussed. A summary of the parachute performance obtained from the development and qualification test programs is presented, together with the results of the performance of the landing system for the five manned Mercury flights. The design objectives and guidelines for the two-manned Gemini and the three-manned Apollo Command Module spacecraft are described, and their current status is discussed. A brief description of rotors, controllable parachutes, and combination of controllable parachutes and retrorockets for soft-landing applications to future spacecraft is also presented. Author

N64-13915* Avco-Everett Research Lab., Everett Mass.
PRODUCTION OF INTENSE RADIATION HEAT PULSES
J. F. Louis, R. Decher, R. A. Allen, and T. R. Brogan Sep. 1963 15 p refs
(NASA Contract NASw-697)
(NASA CR-55321; AMP-120) OTS: $1.60 ph, $0.80 mf

An experimental setup has been developed for the production of intense radiation heat pulses which can be used to simulate the very high heat-transfer rates due to radiation from the hot gases surrounding bodies at reentry velocities typical of interplanetary flights. Radiation heat transfer rates up to 51 kw/cm^2 were determined at pressures up to four atm absolute. The effective temperature of the gas column was determined by several methods, and the results concur. A theoretical calculation of the radiation heat transfer agrees closely with the experimental result, and it is also found that the aerodynamic heat transfer is much smaller. Different materials were tested in this experimental setup, and the high values obtained for the heat of ablation indicate an important shielding of the material by the vaporized matter between the wall and the arc column. Author

N64-13926 Lockheed Missile and Space Co., Sunnyvale, Calif. Nuclear Space Programs Div.
CHARACTERISTICS OF NUCLEAR ROCKETS AND THE INFLUENCE OF MISSION APPLICATIONS
H. Radd and W. H. Sterbentz 20 Jun. 1963 30 p Presented at the AIAA Summer Meeting, Los Angeles, 17–20 Jun. 1963
(LMSC-A304063; NSP-63-47)

The progression from initial space-mission objectives to some of the specific design problem areas confronted with nuclear rockets in a mission framework is examined. Typical flight modes are described, and, within the context of these modes, some nuclear-rocket parametric relationships are analyzed. Attention is then focused on some of the intrinsic problems associated with the application of nuclear rockets. Author

N64-14110* Stanford U., California
OPERATIONAL METHODS FOR SPACE VEHICLE COUNTDOWN PLANNING
Sidney I. Firstman 22 Nov. 1963 203 p refs
(NASA Contract NASr-21(08); Contract Nonr-225(53))
(Tech. Rept. 69; AD-426462)

The purpose and effectiveness of a countdown are discussed. The countdown planning problem is then formally structured through the use of a game-oriented formulation that demonstrates the impact of operational factors upon the countdown. Several assumptions are required in order to reduce the planning problem to one that is computationally tractable. These assumptions are described, and a Markovian prediction model is developed. The problems of obtaining a feasible countdown sequence and computational techniques for planning an acceptable sequence are considered. A discussion is then presented of problems introduced by uncertainty concerning the actual state of nature, countdown length problems, and the derivation of expressions for the moments of an interrupted countdown. R.T.K.

N64-14155* RAND Corp., Santa Monica, Calif.
OPERATIONS RESEARCH APPLICATIONS IN SUPPORT PLANNING FOR MANNED SPACE FLIGHT
Sidney I. Firstman Oct. 1963 11 p Presented at the Natl. Meeting of the Operation Res. Soc., Seattle, Nov. 1963
(NASA Contract NASr-21(08))
(NASA CR-55284; P-2809) OTS: $1.60 ph, $0.80 mf

Launch base planning comprises traditional problems, such as the development of maintenance policies including possible preventive maintenance, and new problems, such as countdown planning where mathematical models can account for operational factors and be used to help improve launch effectiveness. Support planning for missions in space requires the resolution of problems in decision making, spare parts kit planning, optimal timing of activities, and other problems requiring an operational-mathematical approach. This paper explores applications of Operations Research to the planning of support aspects of the Apollo mission and system and, against this background, generalizes to the potential roles of Operations Research in planning for the support of manned spaceflight. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-13937* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH FIFTH SATURN News Release No. 63-268
23 Jan. 1964 53 p
Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

The first complete Saturn vehicle will be launched no earlier than January 27, 1964, according to the National Aeronautics and Space Administration. This vehicle will be the fifth Saturn to be fired (SA-5), the first of the block II version of the vehicle in which the second stage is live and an earth orbital capability exists. SA-5 is the most powerful and most heavily instrumented rocket ever to be launched by the United States. The main purposes of the flight are to further test the first stage (S-I), to demonstrate separation of the S-I stage and the second stage (S-IV), and to test the function of the S-IV propulsion system that uses liquid hydrogen to provide a performance more than a third greater than conventional fuels such as the fuel used in the S-I stage. If all systems perform as expected, an inert payload of 38,000 pounds will be placed in earth orbit. P.V.E.

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-13938* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH SIXTH RANGER News Release No. 64-16
26 Jan. 1964 55 p
Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

According to NASA, the sixth Ranger spacecraft will be launched on a lunar photographic mission by an Atlas-Agena vehicle from Cape Kennedy, Florida, no earlier than January 30. Although this is the sixth Ranger mission, the spacecraft will be called Ranger A to conform with a recent NASA change in spacecraft designations. If the launch is successful, the spacecraft will be named Ranger VI. Among the topics discussed are: (1) previous Ranger missions, and the Ranger improvement program; (2) Ranger A description—power supply, midcourse motor, communications, stabilization system, television system, Ranger dimensions, and Ranger weight; (3) Atlas-Agena launch vehicle—Agena B second stage and Atlas D booster stage; (4) Ranger A trajectory; (5) mission description—launch and separation, acquisition modes, midcourse maneuver, terminal sequence, and television system operation; (6) Deep Space Network; and (7) Ranger A team. R.T.K.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-13498 Hamburger Flugzeugbau (W. Germany)
ON WING ASSEMBLY DURABILITY OF THE COMMERCIAL AIRCRAFT "HFB 320 HANSA" [ZUR TRAGWERKS - BETRIEBSFESTIGKEIT DES GESCHAFTS-FLUGZEUGES "HFB 320 HANSA"]
E. Gassner (Laboratorium für Betriebsfestigkeit, Darmstadt) and W. Wegner 1963 21 p refs Presented at the 1963 Ann. Meeting of the Wiss. Ges. für Luft- und Raumfahrt, Munich, 8–12 Oct. 1963 In GERMAN

The service-life demanded of modern passenger planes requires special emphasis on operational stability. The high-speed of aircraft and the negative sweep of the elastic wings, which increase the Böen effect, require basic information on the concomitant loading, whereby the main interest is directed to the area of the junction of the wings to the fuselage. Collective loads, which were compounded from rolling on the ground, from earth-air loads and from Böen loads, were established. A symetrical profile with an average flight altitude was determined by a comparison and combination of the various flight programs. The various Böen loads were calculated from various flight conditions, i.e., ascent, cruise, decent, "waiting" flight, and gliding approach with actuated landing flaps. The relative frequency of the occurring Böen was established with the help of R.A.S. data sheets, and the collective loading was recalculated as the collective strain. In applying this strain data method to the H.F.B. 320 Hansa, now under construction, it was found that a lifetime of 7500 flights with an average safety factor of 5.1 could be expected. I.v.L.

N64-13547 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
EXPERIMENTAL AND THEORETICAL RESULTS CONCERNING THE PROTECTIVE ABILITY OF A THIN SHIELD AGAINST HYPERVELOCITY PROJECTILES

C. J. Maiden *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 69–156 refs (See N64-13543 05-01)

Results are presented from a theoretical and experimental program investigating the protective value of a thin shield, spaced at a distance from the main hull of the vehicle, against hypervelocity projectiles. The experimental and theoretical results are described separately and compared. C.L.W.

N64-13550* General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
AN INVESTIGATION OF THE PENETRATION OF HYPERVELOCITY PROJECTILES INTO COMPOSITE LAMINATES
A. R. Mc Millan *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30-May 2, 1963, Vol. 3, Aug. 1963 p 309-356 refs (See N64-13543 05-01)
(NASA Contract NASw-468; Contract Nonr-3891-(00) (X))

Targets were impacted under simulated operating conditions at velocities up to 26,000 fps with glass and aluminum projectiles weighing from 0.015 to 0.05 g. In the experiments, such target design variables as thickness, material composition, and temperature were considered. The aim of the research program was to obtain data related to broad concepts of design showin the damage sustained by generic complex targets under impact conditions typical of an operating environment. Author

N64-13553 Glasgow U. (Gt. Brit.)
INTRODUCTORY SURVEY
W. J. Duncan *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. I: Structural Aspects Jan. 1961 53 p refs (See N64-13552 05-01)

Topics discussed are: (1) dynamical variables and equations of motion; (2) representation of the structure; (3) representation of the aerodynamic forces; (4) methods for solving the dynamical equations; (5) stability and stability criteria; (6) classification of aeroelastic phenomena; (7) divergence; (8) reversal of control; (9) flutter—types of flutter, causation of flutter, theoretical prediction of critical flutter speeds, choice of freedoms, experiments with models, full-scale tests, and prevention of flutter; (10) influence of aeroelasticity on general stability, control, and response; (11) impulsive loading; (12) buffeting and noise; (13) kinetic heating; (14) experimental methods and the use of modes; (15) some practical aspects of aeroelasticity; and (16) the early history of aeroelasticity. R.T.K.

N64-13554 College of Aeronautics, Cranfield (Gt. Brit.)
ANALYTICAL REPRESENTATION OF THE DEFORMATION OF STRUCTURES
W. S. Hemp *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. I: Structural Aspects Jan. 1961 22 p refs (See N64-13552 05-01)

The following topics concerning the relationship between external forces applied to an airplane and the resulting deformation of the structure are discussed: (1) reference axes; (2) components of displacement and rotation; (3) specification of the deformation; (4) assumptions appropriate to special problems; (5) calculation of the strain components; (6) formulae for the strain energy; (7) example of a nonswept wing; (8) application of the principle of virtual work; (9) completion of the solution; and (10) summary of the calculation procedure. R.T.K.

N64-13555* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATION ANALYSIS OF AIRCRAFT STRUCTURES
John M. Hedgepeth *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 20 p refs (See N64-13552 05-01)

A discussion is presented of some of the approaches for the analytical determination of natural vibration characteristics of aircraft structures. The topics discussed are : (1) variational approach; (2) the influence–coefficient approach—influence coefficients, mass matrix, matrix vibration analysis, and generalization to other types of degrees of freedom; (3) methods combining continuum and discrete techniques—variational method using influence coefficients, Stein–Sanders procedure, etc.; (4) vibration theory—secondary effects, comparison with experiment for the purpose of evaluation, and vibrations of thin shells. R.T.K.

N64-13556 Liége U. (Belgium)
INFLUENCE OF INTERNAL DAMPING ON AIRCRAFT RESONANCE
B. M. Fraeijs de Veubeke *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 40 p refs (See N64-13552 05-01)

The discussion concerning the influence of damping is divided into three parts. In the first part, a Maxwell model involving a single "hidden" coordinate furnishes a satisfactory type of viscoelastic damping. The transient behavior is described by a heredity function that shows how the damping force depends on the past history of the motion. The concept of heredity function extended to a large, eventually infinite, number of internal freedoms can provide a correct formulation. In the second part, the resonance in one-degree-of-freedom under simple viscous damping, hereditary damping, and structural damping is analyzed. In the third part, resonance in many degrees-of-freedom is discussed with the help of matrix formulation. R.T.K.

N64-13557 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneaux
VIBRATION TESTING BY HARMONIC EXCITATION
H. Gauzy *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 23 p refs (See N64-13552 05 01)

The study of vibration testing is discussed as follows: (1) conservative linear structures; (2) dissipative linear structures; (3) assumptions on the distribution of internal damping; (4) excitation of a natural shape; (5) determination of generalized masses; and (6) impedance testing on nonlinear structures. R.T.K.

N64-13558 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneaux
VIBRATION TESTING BY TRANSIENT EXCITATION
G. Coupry *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 19 p refs (See N64-13552 05 -01)

A discussion is presented of the analysis of the vibration characteristics of a structure by the method of transient excitation. This technique, which was developed in connection with flight flutter tests, proved useful in ground vibration testing and in completing and confirming measurements obtained by orthodox methods. The main problems posed by ground tests using the method of impact or release, with regard to excitation, analysis, and recording, are discussed. R.T.K.

N64-13563 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

STRUCTURAL NON-LINEARITIES

D. L. Woodcock *In* AGARD Manual on Aeroelasticity. Vol. 1, Pt. 1: Structural Aspects Jan. 1961 52 p refs (See N64-13552 05-01)

A survey was made of the various methods available for the solution of nonlinear dynamical problems. The following topics are considered: (1) structural nonlinearities which may arise in flutter and vibration problems; (2) methods of solution of dynamical problems with structural nonlinearities; (3) the behavior of nonlinear dynamical systems; and (4) the effect of structural nonlinearities on flutter. R.T.K.

N64-13628 Aerospace Corp., El Segundo, Calif

FLUTTER AND VIBRATION ANALYSIS BY A MODAL METHOD: ANALYTICAL DEVELOPMENT AND COMPUTATIONAL PROCEDURE

William P. Rodden, Edith F. Farkas, and Heather A. Malcom 31 Jul. 1963 222 p refs

(Contract AF 04(695)-169)

(SSD-TDR-63-158; TDR-169(3230-11)TN-15; AD-426189)

A modal solution of the flutter and vibration problems for a multiple component system is presented. The formulation requires the aerodynamic characteristics in the form of aerodynamic influence coefficients, and the structural and inertial characteristics in the form of free vibration modes and frequencies and a mass matrix for each component. The use of a rigid-body modal matrix permits a general analysis for a system free in space with up to six rigid-body degrees of freedom. The solution also utilizes a newly developed subroutine for finding the eigenvalues and eigenvectors of a non-Hermitian matrix having close roots, and obtains the corresponding values of frequency, required structural damping, and velocity of the flutter system. Author

N64-13893 Vermont U., Burlington

THE EFFECT OF REPEATED LOADING ON FILAMENT WOUND INTERNAL PRESSURE VESSELS

John O. Outwater 5 Sep. 1963 17 p refs

(Contract Nonr-3219(01)(X))

(AD-422860; Tech. Memo-229)

By subjecting thin filament-wound internal pressure vessels to repeated loads with different rates of loading, load ranges, and duration of peak loads, it is concluded that the principal factor involved in the fatiguing of the vessels is the total duration under load. The life of a vessel under cyclic loading is about the same as might be expected if the vessel were held at the maximum load until failure through static fatigue. An explanation for this behavior is made qualitatively by examining the acoustical behavior of a vessel under repeated loading. Author

N64-14001 Army Materials Research Agency, Watertown, Mass. Materials Engineering Lab.

RECTANGULAR TENSILE SHEET WITH EDGE CRACKS

Oscar L. Bowie Aug. 1963 18 p refs

(AMRA-TR-63-22; AD-423444)

Complex variable methods are applied to the plane elastic problem of a rectangular tensile sheet with edge cracks. A mapping function is used which is sufficiently flexible to account for both variations of crack length and length-width ratios of the sheet on the stresses local to the crack tips. Numerical results are carried out and compared with the approximation derived from Westergaard's solution. Author

N64-14002 Massachusetts Inst. of Tech., Cambridge Aeroelastic and Structures Research Lab.

PLASTIC DEFORMATION AND FAILURE OF SILVER-STEEL FILAMENTARY COMPOSITE MATERIALS

Henry R. Piehler Nov. 1963 22 p refs

(Contract AF 49(638)-775)

(ASRL-TR-94-5; AD-426348)

Continuous 7- and 19-filament close-packed silver-steel filamentary composite materials were tested in tension. The specimens were prepared from silver-plated piano wires that were inserted in a silver tube, compacted by wire drawing, and sintered in the solid state. The early stages of the composite plastic stress-strain curves followed a linear mixture rule constructed from the properties of the individual components. The composite elongations at failure, however, were about twice the elongations observed when the filaments were tested alone. The composite ultimate tensile strengths were also above a mixture rule constructed from the ultimate tensile stress of the filaments and the flow stress of the matrix at a strain equal to the elongation at failure of the filaments. These increases in elongation and ultimate tensile strength are explained in terms of a lateral restraint to necking in the filaments which develops in the deforming composite. Author

N64-14009 Lockheed-California Co., Burbank

FATIGUE BEHAVIOR OF MATERIALS FOR THE SUPERSONIC TRANSPORT First Quarterly Report, 1 May-31 Jul. 1963

A. J. Mc Culloch [1963] 35 p

(Contract AF 33(657)-11460)

(LR-17129; AD-419295)

The fatigue behavior of candidate sheet materials subjected to supersonic transport load-temperature environments is being evaluated. Three specimen geometries in each of three materials will be used. Constant load amplitude tests will be carried out on specimens without prior exposure and on specimens exposed to load at temperatures of 400° and 650° F for periods of 100, 1,000, and 5,000 hr. The effects of contaminants will be similarly evaluated using exposure at 650° F for 1,000 hr. In addition, realistic wing root loading spectra will be applied on a flight-by-flight basis. Tests will be carried out to evaluate the effect of the cycle of pressurization and thermal loading which occurs in fuselage skins once every flight. Author

N64-14020 RAND Corp., Santa Monica, Calif.

PROBABILITY AND SCATTER IN CUMULATIVE FATIGUE DAMAGE

Lloyd Kaechele Dec. 1963 76 p refs

(Contract AF 49(638)-700)

(RM-3688-PR; AD-426478)

A study of the problems in aircraft design caused by scatter in fatigue life is presented, and an approach to probability and scatter in spectrum loading is presented which is consistent with cumulative-damage theories. In many structures, adequate design for static loads and proper attention to details of design that are important in fatigue result in a structure with practically zero probability of fatigue failure all through its lifetime. In other cases, statically adequate structures may be marginal or completely inadequate as far as fatigue is concerned. The fact that slight additions of material produce large increments in fatigue life makes it possible to produce an anti-fatigue design with little weight penalty. The approach described can supply a reference distribution that can be used in preliminary fatigue designs and also in studying and identifying factors that change observed life under spectrum loading. P.V.E.

N64-14053 Aeronautical Research Labs., Melbourne (Australia)
A NOTE ON MODIFICATIONS IN REDUNDANT STRUCTURES
B. C. Hoskin Melbourne, Dept. of Supply, Apr. 1963 13 p refs
(ARL/SM-280)

Using the method of matrix transformations, Argyris developed a formula whereby the effect that the modification of the stiffnesses of a few elements of a structure has on an existing load distribution can be readily determined. The original development of the formula was based on a combination of physical and mathematical arguments, and occasionally some controversy has arisen concerning the validity of the former. Thus it may be considered worthwhile demonstrating that the formula can be derived solely by mathematical arguments as is done in this note. Author

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads.

N64-13546 Lockheed Missiles and Space Co., Palo Alto, Calif.
A METEOROID BUMPER DESIGN CRITERION
P. E. Sandorff *In* Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, Apr. 30–May 2, 1963, Vol. 3 Aug. 1963 p 41-67 refs (See N64-13543 05-01)

The design concept and the principles of operation of a "Whipple" meteor bumper are reviewed, the importance of material properties is investigated, and the physical process of hypervelocity impact is analyzed. Consideration is given to the application of one-dimensional shock-wave mechanics in the complete pulverization of the incident hypervelocity particle by the meteor bumper. One-dimensional shock-wave mechanics permits estimation of the effectiveness of a Whipple bumper in breaking up an incident projectile or meteoroid, and leads to a qualitative design criterion for required bumper thickness. The density of both projectile and target was found to be the most important material property affecting bumper performance, but other properties, at extreme pressures, influence the performance to a noticeable degree. C.L.W.

N64-13840 Naval Research Labs., Washington, D.C.
PRACTICAL CONSIDERATIONS IN APPLYING LABORATORY FRACTURE TEST CRITERIA TO THE FRACTURE-SAFE DESIGN OF PRESSURE VESSELS
W. S. Pellini and P. P. Puzak 5 Nov. 1963 34 p refs Presented at the ASME Winter Ann. Meeting Symp. on Behavior of Pressure Vessels Mater., Phila., Pa., Nov. 17–22, 1963
(NRL-6030; AD-426431)

A "broad look" analysis is presented of the opportunities to apply new scientific approaches to fracture-safe design in pressure vessels and of the new problems that have arisen in connection with the utilization of higher strength steels. These opportunities follow from the development of the fracture analysis diagram which depicts the relationships of flaw size and stress level for fracture in the transition range of steels that have well-defined transition temperature features. The reference criteria for the use of the fracture analysis diagram is the NDT temperature of the steel, as determined directly by the drop-weight test or indirectly by correlation with the Charpy V test. Potential difficulties in the correlation use of the Charpy V test are deduced to require engineering interpretation of Charpy V test data rather than to involve basic barriers to the use of the test. The rapid extension of pressure vessel fabrication to Q&T steels is expected to provide new problems of fracture-safe design. These derive from the susceptibilities of steels within this family to tear fractures of low energy absorption. This fracture mode does not involve a transition temperature and is therefore relatively independent of temperature. It is emphasized that such susceptibilities are not inherent to the family of Q&T steels of low and intermediate strength levels, but are related to specific metallurgical conditions of the plate and particularly the HAZ (heat-affected-zone) regions of Q&T steel weldments. Author

N64-13909 Los Alamos Scientific Lab., N. Mex.
PRESTRESSED CONCRETE SPHERICAL CONTAINMENT VESSEL
D. W. Mueller and A. P. Furnish, 14 Jan. 1964 66 p
(Contract W-7405-eng-36)
(LA-2901) OTS: $1.50

This report describes a 20-ft-OD, 16-ft-ID, prestressed spherical concrete shell having an outer steel skin, which was designed to serve as a container for explosions. This 20-ft containment vessel, which has not been built, is described. Design specifications are given, and reproductions of the original engineering drawings are included. A quarter-scale model of the vessel, which was built and tested to destruction with high explosives, is described. Results of the tests are given. Author

N64-14023 Rohm and Haas Co., Huntsville, Ala. Redstone Arsenal Research Div.
MATHEMATICAL STUDIES OF COMPOSITE MATERIALS [Final Report, 15 Oct. 1962-31 May 1963]
Howard B. Wilson, Jr. 17 Dec. 1963 54 p refs
(Contract DA-01-021-ORD-11878)
(S-42; AD-426838)

Several types of idealized composite material systems are discussed. A bibliography pertaining to the analysis of stresses in such systems under the assumption of linear elasticity is given. Solutions by complex variable methods are presented for three mixed boundary-value problems concerning an infinite plane with a circular or elliptic hole and containing an insert in partial contact with the hole. Author

Collections of NASA Documents

NASA is depositing its technical documents and bibliographic tools in twelve Federal Regional Technical Report Centers. Each Center, located in the organizations listed below, is prepared to furnish the general public such services as personal reference, inter-library loans, photocopy service, and assistance in obtaining retention copies of NASA documents.

California: University of California, Berkeley
University of California, Los Angeles
Colorado: University of Colorado Libraries, Boulder
District of Columbia: Library of Congress
Georgia: Georgia Institute of Technology, Atlanta
Illinois: The John Crerar Library, Chicago
Massachusetts: MIT, Cambridge
Missouri: Linda Hall Library, Kansas City
New York: Columbia University, New York
Pennsylvania: Carnegie Library of Pittsburgh
Texas: Southern Methodist University, Dallas
Washington: University of Washington Library, Seattle

In addition, NASA publications are currently being forwarded to the public libraries in the cities listed below:

Alabama: Birmingham
Alaska: Anchorage
Arizona: Phoenix
Arkansas: Little Rock
California: Fresno, Los Angeles, San Diego, San Francisco
Colorado: Denver
Connecticut: East Hartford, Bridgeport
Delaware: Wilmington
Florida: Jacksonville
Georgia: Atlanta
Idaho: Boise
Illinois: Springfield
Indiana: Fort Wayne, Indianapolis
Iowa: Des Moines
Kansas: Wichita
Kentucky: Louisville
Louisiana: New Orleans
Maine: Portland
Maryland: Baltimore
Massachusetts: Boston
Michigan: Detroit
Minnesota: St. Paul
Mississippi: Jackson
Missouri: Kansas City
Montana: Helena
Nebraska: Omaha
New Hampshire: Manchester
New Jersey: Trenton
New York: New York State Library
North Carolina: Winston-Salem
Ohio: Akron
Cleveland Public Library
Oklahoma: Oklahoma City
Oregon: Portland
Pennsylvania: Philadelphia
South Carolina: Rock Hill
South Dakota: Sioux Falls
Tennessee: Memphis
Texas: Dallas, Houston
Washington: Seattle
Wisconsin: Milwaukee